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PERFORMANCE MEASUREMENTS ON THE NF-105 FIELD INTENSITY METER

by

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Boulder, Colorado

NBS Report 7635

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Prepared
for
Rome Air Development Center
Air Force Systems Command
United States Air Force
Griffiss Air Force Base
New York

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FOREWORD

This is an interim ~~report~~ rept. which covers the examination and evaluation of the NF/105 field-intensity meter. This work was sponsored by Rome Air Development Center, Air Force Systems Command, United States Air Force, Griffiss Air Force Base, New York. The management and technical supervision of this program was under the cognizance of Mr. L. F. Moses of RADC.

The author wishes to express his appreciation to George Blake for his assistance in making measurements and to C. C. Watterson and H. V. Cottony for suggestions which they contributed.

PERFORMANCE MEASUREMENTS ON THE NF-105 FIELD-INTENSITY METER

Abstract

The radio field intensity meter, NF-105, Serial Number 1845,was compared with the AN/TRM7(XA-1) and the NM 30A field intensity meters. The NF-105 field-intensity meter covers the frequency range from 150 kc to 1000 Mc.

Performance measurements of this meter were conducted to determine the accuracy of the indicator circuitry and the ability of the instrument to furnish realistic data on radio-frequency fields. These measurements are used for reference and evaluation and to correlate with other instruments performing the same type of tests in the same environment. The data in this report are for use in making rms CW field measurements only and are not valid for broadband interference measurements.

Field strength may be determined with the loop and dipole antennas which are furnished with the meter in accordance with the following formula:

$$E = K + M + A$$

where E = unknown field strength in decibels above one microvolt/ meter

K = antenna coefficient in decibels
M = corrected meter reading in decibels
A = corrected attenuator setting in decibels

An effort has been made to describe tests which affect field strength measurements and to supplement the conclusions of this report with calibration charts and curves.

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PERFORMANCE MEASUREMENTS ON THE NF-105 FIELD INTENSITY METER

1. *INTRODUCTION

This report presents the results of performance measurements which have been carried out on the radio field intensity meter model NF-105, Serial Number 1845. This meter which is a highly sensitive superheterodyne receiver for the frequency range 150 Mc/s to 1000 Mc/s functions as a two-terminal voltmeter. It has a sensitivity capable of measuring signals from one microvolt to one hundred thousand microvolts. Carrier and peak measurements are available be means of a selector-switch control. When the selector switch is in the carrier position the indicator reads peak voltages of unmodulated signals and average values for modulated signals, and when the function switch is in the peak position, peak voltages of pulses or carriers are indicated.

The performance of the slide-back peak VTVM is determined by the audio amplifier, which provides a slide-back detector cutoff point and has enough gain in the output stage to produce an audible level for measuring low-duty cycle pulsed interference.

The minimum pulse width which appears at the input of the audio amplifier is equal to the reciprocal of the bandwidth of the NF-105. Bandwidth measurements indicate the bandwidth to be 15 kc between the 6 db points. Therefore, the average pulse width of the impulse response is the reciprocal of the bandwidth which in this case is 66 microseconds.

The frequency-selector circuits in this receiver are the superheterodyne type and need no explanation as to theory and operation. However, the choice of time constants and the bandwidth of the NF-105 affect the capability of the detector and indicator circuitry to furnish data on radiated radio interference.

This report is intended for a record of laboratory measurements on the NF-105 as a field strength meter.* These measurements may be used to compare and evaluate the NF-105 with other instruments. The following tests were performed by Division 92: Test No. 50353:

1. Attenuator calibration
2. Two terminal rf voltmeter calibration
3. Antenna calibration
4. Overall Linearity calibration

*Note: In this report the term "field strength" is used to designate the magnitude of the electric field vector in volts per meter.

It is important that the above parameters be stable and accurately known for precision field strength measurements. Reference is made here to similar tests performed and described by the University of Pennsylvania, Moore School of Electrical Engineering: "Investigation of the Measurement of Noise".

2. DESCRIPTION

The field intensity meter model NF-105 is intended for use in the frequency range from 150 kc to 1000 Mc. This frequency range is covered by means of four plug-in heads which house the rf and IF circuits. The basic measuring unit contains detectors and audio circuits, calibrating standards, attenuators and indicating circuits as well as a regulated power supply. In addition, dipole antennas, magnetic electric line probes, injection blocks, cables and carrying cases are furnished with the instrument.

The frequency range from 150 kc to 30 Mc is covered by the tuning unit, TA/NF-105 in six bands. The tuning unit T1 /NF-105 frequency range is 20 to 200 Mc in two bands; tuning unit T-2/NF-105, 200 to 400 Mc in one band; tuning unit T-3/NF-105, 400 to 1000 Mc in two bands.

The measuring voltage interval of the NF-105 is 1 microvolt to 100,000 microvolts. The input impedance is nominally 50 ohms. The calibrating impulse noise source has a pulse repetition rate of 2.5 to 2500 cycles, and a pulse spectrum which up to 1000 Mc varies less than ± ½db; and the pulse amplitude is variable from 37 to 97 db above 1 microvolt per megacycle bandwidth.

The indicating meter has a 4½" logarithmic movement calibrated in microvolts (0.5 to 10) and in decibels (-6 to +20).

The basic unit and accessories are illustrated in Figures 1 and 2.

3. PERFORMANCE TESTS

Data is presented from acceptance tests which have been performed on the NF-105 field intensity meter. A particular effort has been made to cite measurements which involve field strength determinations. This report also provides supplementary calibration charts and curves.

3.1 Internal Noise

Internal noise, as referred to in this report, is defined as the reading of the output meter of the instrument when no signal is being fed into the input. This check was made by feeding a signal of sufficient intensity to produce a full scale deflection of the output meter into the input of the instrument. The signal was removed and the antenna input capped. With no adjustment of the instrument gain, the indication on the output meter is a measure of the internal noise of the receiver. The variation in the intensity of this noise with changes in tuning frequency is illustrated in Figure 3.

3.2 Accuracy of Frequency Scale Tracking

The accuracy of frequency scale tracking was determined by comparing the indicated frequency of the NF - 105 with the frequency of a calibrated signal generator. The signal generator was tuned to a receiver dial frequency and peaked to resonance, then the frequency was measured using a frequency counter. Four points on each band were utilized to cover the frequency range of that band. The percentage error is illustrated in Figure 4.

3.3 Attenuator Calibration

This calibration was performed with the function switch placed in the "CARRIER" position, and the IF gain adjusted in accordance with the two-terminal rf voltmeter calibration data. The corrected attenuator settings are referenced to the "20" db attenuator setting. This calibration is accurate within 0.1 db plus 0.3 per cent of the attenuation in db at frequencies up to 450 Mc and within 0.1 db plus 0.5 per cent of the attenuation from 450 to 1000 Mc. [Div. 92 Test No. 50353, February 7, 1962.]

Attenuator Setting decibels	Corrected Attenuator Setting decibels					
	0.15 Mc	50 Mc	150 Mc	300 Mc	450 Mc	1000 Mc
0	1.3	0.2	0.0	-2.4	-5.4	-4.3
20	20.0	20.0	20.0	20.0	20.0	20.0
40	40.0	40.1	40.0	40.0	40.0	40.6
60	60.1	60.2	60.1	60.0	60.1	60.1
80	80.1	80.2	80.0	80.0	80.0	79.9

3.4 Two-Terminal RF Voltmeter Calibration

This calibration was performed by applying 100 microvolts to the 30-foot rf cable (CB-105) which was connected to the ANTENNA connector on Switching Unit SU-105 with the signal input attenuator in the "20" db position, the function switch in the CARRIER position and the IF gain adjusted to an output meter reading of 20 decibels. The impulse generator settings were determined with the signal input attenuator in the "20" db position and the function switch in the PEAK position. The pulse repetition rate of the impulse generator was set at 1000 cycles. The input voltage was accurate to within 5 per cent to 400 Mc/s and within 10 per cent from 400 to 1000 Mc/s.

Tuning Unit	Band	Frequency Mc	Impulse Generator Setting decibels
T-A/NF-105	1	0.15	87.0
		0.19	85.6
		0.23	85.4
		0.27	84.8
		0.31	84.4
		0.36	84.3
	2	0.36	80.0
		0.46	79.4
		0.56	77.8
		0.66	75.5
		0.76	74.7
		0.87	75.5
	3	0.87	80.0
		1.12	76.8
		1.40	76.8
		1.65	77.1
		1.90	77.8
		2.10	77.8
	4	2.10	74.8
		2.70	74.3
		3.35	73.6
		4.00	73.5
		4.60	73.6
		5.20	73.7
	5	5.2	75.2
		6.7	74.8
		8.2	74.4
		9.7	73.9
		11.2	73.3
		12.7	73.2
	6	12.7	73.9
		16.2	74.0
		19.7	74.0
		23.2	74.1
		26.7	74.3
		30.0	75.0

Tuning Unit	Band	Frequency Mc	Impulse Generator Setting decibels
T-1/NF-105	1	30	58.1
		38	59.0
		43	59.0
		50	58.3
		54	57.6
		65	57.5
	2	65	57.8
		88	59.2
		125	59.2
		150	59.3
		175	58.8
		200	59.5
T-2/NF-105	1	200	50.3
		240	50.4
		275	49.4
		300	50.2
		330	50.6
		400	50.6
T-3/NF-105	1	400	44.0
		450	45.4
		500	48.0
		550	46.6
		600	44.4
		650	44.2
		700	48.8
	2	700	46.2
		750	44.9
		800	45.8
		850	46.6
		900	47.2
		950	47.3
		1000	46.4

3.5 Meter Scale Tracking

The meter scale tracking test evaluates the ability of the instrument to correctly indicate amplitudes below full scale. It was assumed that the NF-105 had been calibrated at full scale. In this case meter scale tracking was determined by comparing the calibrated output attenuator of the signal generator with the indicated voltage of the NF/105. The attenuator of the calibrated signal generator was reduced in 1 microvolt steps and the NF-105 indicator position was recorded. This test was repeated for 8 levels at each of ten frequencies covering the range of the receiver to determine accuracy of the metering circuit. The results of this test are illustrated in Figure 5.

3.6 Gain Stability vs. Power Line Voltages

This test was made to determine the proper operation of the voltage regulator when the power line voltage fluctuates from 105 volts to 125 volts, and the effects upon rf power readings with these variations.

With a signal applied giving a 6000 microvolt indication on the output meter, the line voltage was varied by means of a Variac starting at the normal level of 115 volts, then increasing the voltage to 125 volts AC, then decreasing in 5 volt steps to 105 volts AC. The results of this test are shown below.

Variac Output	Output Meter	Output Meter Variation in %
125	6000 μv	0
120	6000 μv	0
115	6000 μv	0
110	5800 μv	3.3
105	5800 μv	3.3

3.7 Bandwidth Measurements

Bandwidth is commonly defined as the range over which the response does not fall below the response at the center frequency by more than some specified value. In this case, 6 db was chosen. Tests were made at eight center frequency points which cover the range of the NF-105 receiver.

With the NF-105 tuned to the center frequencies selected and the gain control fixed for full scale deflection when a 1000 microvolt signal is injected at the rf input of the receiver, then with the function switch in the PEAK position and the gain standardized the signal generator was tuned to a succession of frequencies above and below the center frequency. The resulting output was then plotted in db versus frequency and the resulting curves are illustrated in Figures 6 through 13.

3.8 Image Rejection

The ratios here determined give the relative gain of the receiver to an input signal at its tuned frequency and an input signal image of the IF frequency in db.

The NF-105 receiver was tuned to a driving signal generator frequency with the gain adjusted for full scale deflection. Then without changing the receiver frequency or changing the gain control, a signal was introduced equal to the tuned frequency, plus or minus the IF frequency. The amplitude of these signals was plotted in microvolts versus frequency and illustrated in Figures 14, 15, and 16.

3.9 Local Oscillator Radiation

The local oscillator radiation was determined by measuring the strength of the oscillator signal which appeared at the input jack of the NF-105.

The AN/TRM7(XA-1) and the NM30A were used as detectors and voltmeters to evaluate the amplitude of the radiation emitted from the NF-105. The two receivers were required in order to cover the frequency range of the NF-105.

The detected strength of the oscillator signal was recorded and the results of the test are listed below using AN/TRM7(XA-1):

IF Freq. (Mc)	RF Freq. (Mc)	Band	Local Oscillator Frequency (Mc)	Local Oscillator Radiation (μv)
0.455	0.15	I	0.605	11.0
"	0.25	"	0.705	8.4
"	0.35	"	0.805	6.4
1.600	0.45	II	2.05	17.2
"	0.65	"	2.25	15.0
"	0.85	"	2.45	13.0
0.455	1.00	III	1.455	7.8
"	1.50	"	1.955	7.2
"	2.00	"	2.455	11.0
1.600	3.00	IV	4.600	15.0
"	4.00	"	5.600	16.8
"	5.00	"	6.600	18.8
"	6.00	V	7.600	78.0
"	9.00	"	10.600	56.0
"	12.00	"	13.600	39.0
"	15.00	VI	16.600	860.0
"	20.00	"	21.600	750.0
"	25.00	"	26.600	520.0

Local Oscillator Radiation of NF-105
Using NM-30A as a Receiver

NF-105 RF (Mc)	IF (Mc)	NM-30A RF (Mc)	VTVM Meter Reading (μV)	Freq. Band Setting
20	10.7	30.7	80	
45	10.7	55.7	60	
65	10.7	75.7	195	
65	10.7	75.7	70	T-1
120	10.7	130.7	42	
200	10.7	210.7	340	
180	30	210	32	
300	30	330	580	T-2
400	30	430	1250	

3.10 Shielding Effectiveness

The object of this test was the determination of the degree of rejection afforded by the instrument case to the direct effect of radiation. A dipole antenna was connected to the output of the signal generator and another dipole antenna was connected to the input of the NF-105 field strength meter. The NF-105 was then set up to measure or receive signals via the dipole antenna which was oriented for maximum deflection. After the receiver antenna had been removed and the input capped, the loss in intensity at the receiver output was observed. Although the field thus created was not uniform, with the exception of the test at 12.7 Mc/s, the test results remained within the specification of 40 db.

Test Frequency in Mc/s	Meter Reading With Antenna	Meter Reading Without Antenna	Shielding Effectiveness
0.15	75.7	33.5	42.2
0.25	82.5	32.0	50.5
0.36	88.5	33.0	55.5
0.36	78.0	31.0	47.0
0.60	88.0	32.0	56.0
0.87	96.5	38.0	58.5
0.87	86.6	28.8	57.8
1.30	99.7	28.0	71.7
2.10	90.5	27.3	63.2
2.10	92.7	32.5	60.2
4.00	94.3	30.0	64.3
5.20	105.1	31.2	73.9
5.20	114.0	43.3	70.7
7.50	95.0	27.0	68.0
12.70	78.5	29.5	49.0
12.70	62.0	31.0	31.0
20.00	82.0	27.4	54.6
30.00	119.0	31.0	88.0

The following residual noise level should be taken into account, when computing the shielding effectiveness:

RF (Mc)	Meter with Antenna	Meter without Antenna	Internal Noise Level
T-1 75	88 db	3.2 db	3.1 db
T-2 300	80 db	17.5 db	11.1 db
T-3 550	75.5 db	20.0 db	14.6 db
850	57.5 db	20.0 db	15.0 db

3.11 Antenna Calibration

The loop antenna was calibrated in terms of a quasi-static magnetic field. The dipole antennas were calibrated in terms of a horizontally-polarized field for an antenna height of 10 feet. Approximate corrections for other heights may be obtained from NBS Research Paper RP 2062.

Loop antenna LP-105 - The IF gain was adjusted with the function switch placed in the "PEAK" position and the signal input attenuator in the 40 db position using the impulse generator settings listed in Section 3.4 of this report. The antenna coefficients were determined with the function switch placed in the "CARRIER" position. This calibration is accurate within 0.3 db to 5 Mc and within 0.5 db from 5 to 30 Mc.

Tuning Unit	Band	Frequency Mc	Antenna Coefficient decibels
T-A/NF-105	1	0.15	41.0
		0.19	38.8
		0.23	37.9
		0.27	37.4
		0.31	37.0
		0.36	36.4
	2	0.36	37.4
		0.46	35.6
		0.56	34.4
		0.66	33.6
		0.76	32.8
		0.87	32.2
	3	0.87	32.0
		1.12	30.6
		1.40	29.5
		1.65	28.8
		1.90	28.8
		2.10	28.9
	4	2.10	27.8
		2.70	26.5
		3.35	25.4
		4.00	24.1
		4.60	23.7
		5.20	23.3
	5	5.2	24.6
		6.7	22.5
		8.2	21.2
		9.7	20.2
		11.2	19.2
		12.7	18.3
	6	12.7	19.7
		16.2	18.6
		19.7	18.2
		23.2	18.0
		26.7	18.9
		30.0	19.3

Dipole antenna - The IF gain was adjusted with function switch placed in the "PEAK" position and the signal input attenuator in the 20 db position using the impulse generator settings listed. The antenna coefficients were determined with the function switch placed in the "CARRIER" position. This calibration is accurate within 0.8 db to 150 Mc and within 1.2 db from 150 to 330 Mc.

DM-105-T1 Antenna

Tuning Unit	Band	Frequency Mc	Antenna Coefficient decibels
T-1/NF-105	1	30	0.5
		38	3.5
		43	4.7
		50	5.0
		54	4.2
		65	5.4
	2	65	6.0
		88	9.6
		125	14.2
		150	16.6
		175	16.2
		200	17.2

DM-105-T2 Antenna

T-2/NF-105	1	200	17.2
		240	19.6
		275	19.2
		300	20.5
		330	21.2

3.12 Input Impedance

The input impedance of the NF-105 was determined while looking into 30 ft. of RG/55 cable which had been connected to the switching unit SN 105, and the 18" cable of RG/5 5 attached to the input connector of the NF 105 with the attenuator in the 20 db position.

The input to the NF-105 was greater than 100 microvolts. (See Figure 17.)

These measurements were made relative to a 50 ohm load, and do not reflect errors which may occur when the NF105 is used with the 50 ohm and 500 ohm "line probes", in which case the balance is obtained by proper connection to the binding posts.

3.13 Pulse Linearity

The weighting circuits associated with the detector are the very heart of the radio interference and field intensity measuring set. They determine which feature of the interference shall be indicated by the output meter. The weighting circuits are placed at the second detector, the carrier strength, quasi peak, or peak voltage indicated by them refer to the signal after it has passed the radio frequency and intermediate frequency amplifiers stages. If there is any lengthening, or peak depression in these stages the output does not give correct information about the input signal to the instrument.

The NF-105 does not have a quasi-peak indicator, therefore relative carrier and peak readings were taken for narrow pulses (5μsec and 10 μsec) while the repetition frequency was varied. Refer to Mil-I-6181D and ATI 159699 for compliance with this specification.

In the case of the NF-105, peak readings were taken with the function switch in the PEAK position, since in this position the charge time is made short and the discharge time is made long by the use of the 50 meg resistor in the detector circuitry. For carrier measurement, the 50 meg resistor (R86) is shorted by the resistors R71 and R73 to a value of 150,000 ohms. Thus the discharge time is sufficiently shortened to permit average indications rather than peak values. (Refer to manufacturer's operating manual, page 45.)

The first measurements were obtained with the IF gain fixed to normal calibration. See Figure 18. By reducing the gain control to 1/5 the normal position and increasing the signal to five times its original setting, a new set of readings was taken. In effect, the latter situation is an artificial one deliberately arranged so that a test of nonlinearity could be made, with five times the previous signal level through the rf stages as a check of rf linearity. Curves were constructed to indicate the departure from linearity; Figure 18 indicates the nonlinearity with normal gain adjustment and Figure 19 indicates the nonlinearity at 1/5 normal gain position.

3.14 Pulse Response

The carrier detector develops an output amplitude which depends upon the pulse width and repetition frequency as in the previous test. The width of the pulses applied to the detector is determined by the passband characteristics. Pulse widths less than the reciprocal of the bandwidth (10 kc/s) or 100 microseconds and pulse widths greater than the band pass were used. The results of these tests are illustrated in Figures 20 and 21.

3.15 Sine Wave Oscillator

The accuracy of the sine wave oscillator as a continuous wave calibrating standard was determined.

The sine wave calibrator was compared with a calibrated signal generator and frequency counter by connecting it to the signal input connector on the main panel, through the 18" cable and with the input attenuators in the 80 db position. A 6" cable was used to connect the attenuator output to the rf input connector on the plug-in head. With the function switch in the OSCILLATOR ZERO position the oscillator zero control was adjusted for zero reading on the meter. The sine wave oscillator level control was then adjusted for full scale deflection or 100,000 microvolts. The function switch was set to CARRIER position and the receiver tuned to about its "CAL" marking on the dial, or until the signal from the sine wave oscillator caused maximum deflection or resonance. The IF gain control was then varied until the meter indicated full scale of 100,000 microvolts.

The sine wave oscillator was disconnected and without changing the gain or attenuation a signal generator, which delivered a standard 100,000 microvolts output, was then connected in the place of the sine wave oscillator. The meter deflection was recorded.

A frequency counter was used to measure the accuracy of the frequency output at 62 megacycles and 215 megacycles. The results of this test are shown below.

Measured Frequency	Sine Wave Oscillator Output	Calibrated Standard Generator Output
62.762	100,000 μV	100,000 μV
213.846	100,000 μV	100,000 μV

3.16 Overall Linearity Calibration

The over-all linearity was measured from the antenna connector on Switching Unit SU-105 to the panel output meter, referenced to a meter reading of 20 decibels. The measurements were made with the function switch placed in the "CARRIER" position, the signal input attenuator in the "40" db position, and the IF gain adjusted in accordance with the two-terminal rf voltmeter calibration data. This calibration is accurate within 0.1 db plus 0.3% of the attenuation in db at frequencies up to 450 Mc and within 0.1 db plus 0.5% of the attenuation in db from 450 to 1000 Mc.

Indicated Meter Reading decibels	Corrected Meter Reading T-A/NF-105					
	Band 1 0.27 Mc	Band 2 0.56 Mc	Band 3 1.4 Mc	Band 4 4.0 Mc	Band 5 8.2 Mc	Band 6 19.7 Mc
0	1.1	-0.2	1.0	-0.2	-0.2	-0.2
5	5.7	4.4	5.7	4.5	4.5	4.5
10	10.5	9.3	10.5	9.4	9.4	9.4
15	15.3	14.4	15.3	14.5	14.5	14.5
20	20.0	20.0	20.0	20.0	20.0	20.0

	T-1/NF-105		T-2/NF-105	T-3/NF-105	
	Band 1 50 Mc	Band 2 150 Mc	Band 1 300 Mc	Band 1 450 Mc	Band 2 1000 Mc
0	-0.2	-0.4	-2.6	-5.7	-5.8
5	4.6	4.6	3.5	1.0	1.0
10	9.7	9.7	9.0	6.9	6.9
15	14.7	14.8	14.2	12.6	12.6
20	20.0	20.0	20.0	20.0	20.0

3.17 Gain Stability for Long Periods

The test of gain stability and gain standardization was determined by tuning the NF-105 to 850 Mc at an output level of 100 microvolts. Readings were taken of the output indicated, then with the gain control fixed the output amplitude at this frequency and at others was checked at one-hour intervals.

One-hour Intervals, Power Level 100 μV

Test Freq.	1st Hour	2nd Hour	3rd Hour
850 Mc	100 μV	100 μV	100 μV
400 Mc	100 μV	100 μV	100 μV
300 Mc	100 μV	98 μV	97 μV
120 Mc	97 μV	95 μV	92 μV
45 Mc	100 μV	100 μV	100 μV
21 Mc	100 μV	98 μV	96 μV (1600 kc) IF
1 Mc	100 μV	95 μV	93 μV (455 kc) IF

3.18 Overload Capacity

The purpose of this test was to determine the amplitude linearity of the over-all gain when the instrument was being operated with low duty cycle inputs, which were sufficient to give maximum deflection. Overload capacity was determined in the following manner: With the function switch set in the PEAK position and the attenuator set in the 40 db position, a 1000 microvolt signal was applied at the input of the NF-105 and the gain adjusted for full scale deflection, the agc voltage was measured with a vacuum tube voltmeter. Then the agc terminal was disconnected and an external voltage was applied equal to that previously measured. This voltage source consisted of a battery and potentiometer. A 1000 microvolt (sine wave) was again applied and with the gain fixed for full scale deflection, the 1000 microvolt signal was then increased and the bias voltage (required to return the meter to full scale) was measured. The output vs input departed from linearity as indicated below.

Sig. Gen. Output μV	Linear Computed Values - DC	Measured Voltage-DC	Difference Voltage-DC	% Diff. Required
1000	1.9	1.9	0.0	
2000	3.8	3.2	.6	1.6
3000	5.7	3.9	1.8	3.25
4000	7.6	4.4	3.2	4.3
5000	9.5	4.9	4.6	4.8
6000	11.4	5.2	6.2	5.4
7000	13.3	5.5	7.8	5.5
8000	15.2	5.8	9.4	6.1
9000	17.1	6.0	11.1	6.4
10000	19.0	6.3	12.7	6.6

3.19 Audio Response

The capabilities of an aural slideback peak VTVM are determined by the audio amplifier. The audio amplifier provides a slideback detector cutoff point and has enough gain and output drive to produce an audible output level when measuring low duty cycle pulsed signals. The minimum pulse width which will appear at the input to the audio amplifier is, as has been previously indicated, inversely proportional to the receivers impulse bandwidth. A greater impulse bandwidth requires more audio gain in order to make a narrow pulse audible.

The maximum audio output of the NF-105 was measured while the carrier and modulation percentage were held constant. The repetition rate of the modulation was varied from 100 cycles to 15,000 cycles. From these measurements curves were plotted to illustrate the audio response in volts vs. audio repetition frequency. See Figures 22, 23, and 24.

3.20 Correlation Measurements

A comparison of measurements for cw signals through a coaxial switch was made with the NF-105 and the TRM-7.

The receivers were given an initial warm-up time and with equal ambient temperature. A calibrated cw signal of 100 microvolts was fed into a coaxial switch. The output of the coaxial switch then fed the receivers alternately and readings were taken for the same given frequency. These readings were recorded on each frequency band.

Correlation Measurements

rf (Mc)	Sig. Gen Input (μv)	NF-105 (μv)	TRM-7 (μv)
0.15	100	96	98
0.23	100	100	93
0.36	100	97	100
0.46	100	85	100
0.66	100	85	100
0.87	100	92	100
1.12	100	102	101
1.65	100	102	101
2.10	100	98	100
2.70	100	99	100
4.00	100	100	100
5.20	100	101	100
6.70	100	88	100
9.70	100	100	99
12.70	100	104	108
16.20	100	98	130
23.20	100	97	119
26.70	100	95	--

4. CONCLUSION

The NF-105 meets the requirements of specification MIL-I-6181D.

5. REFERENCES

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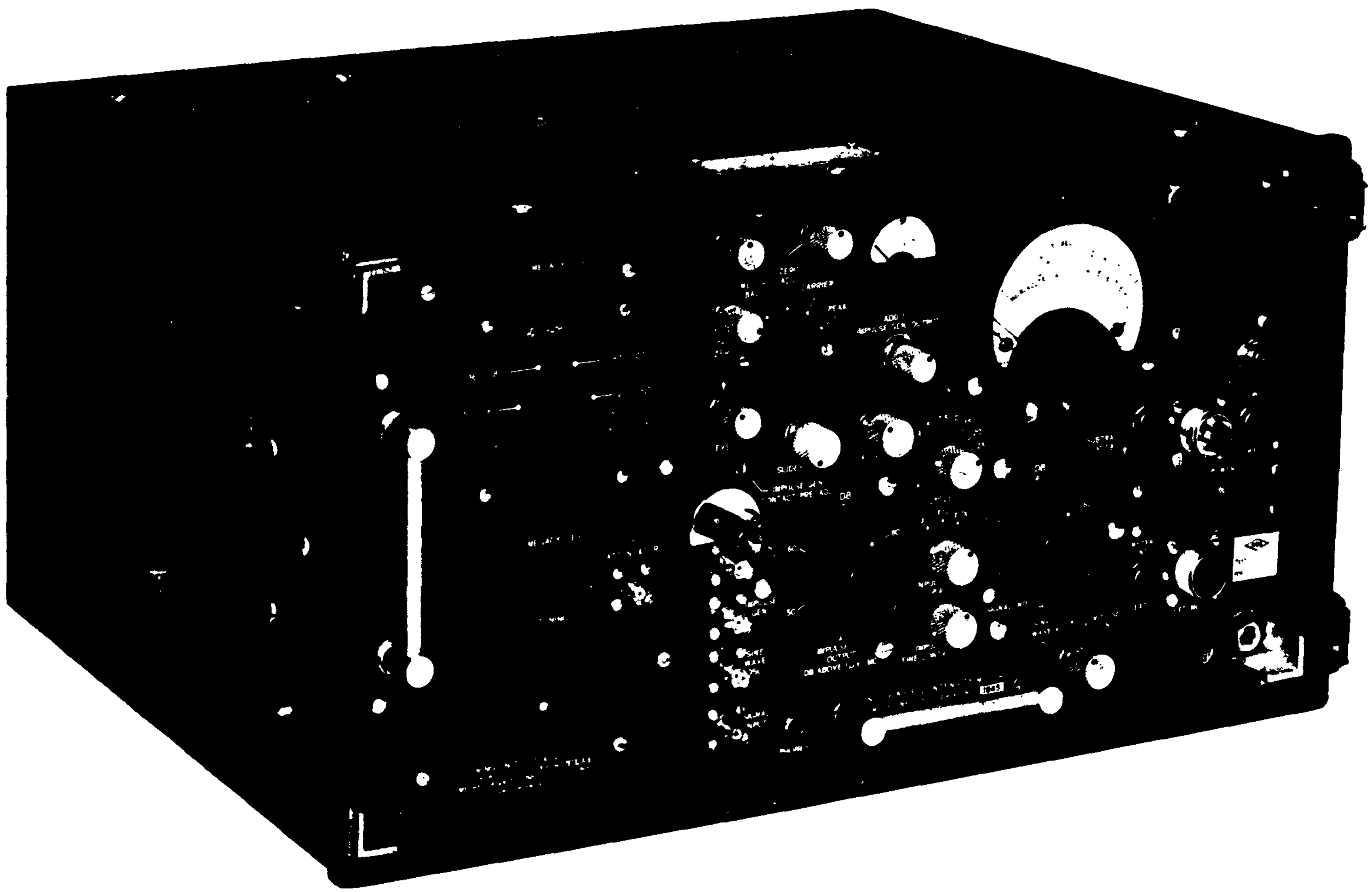


FIG. I BASIC MEASURING UNIT

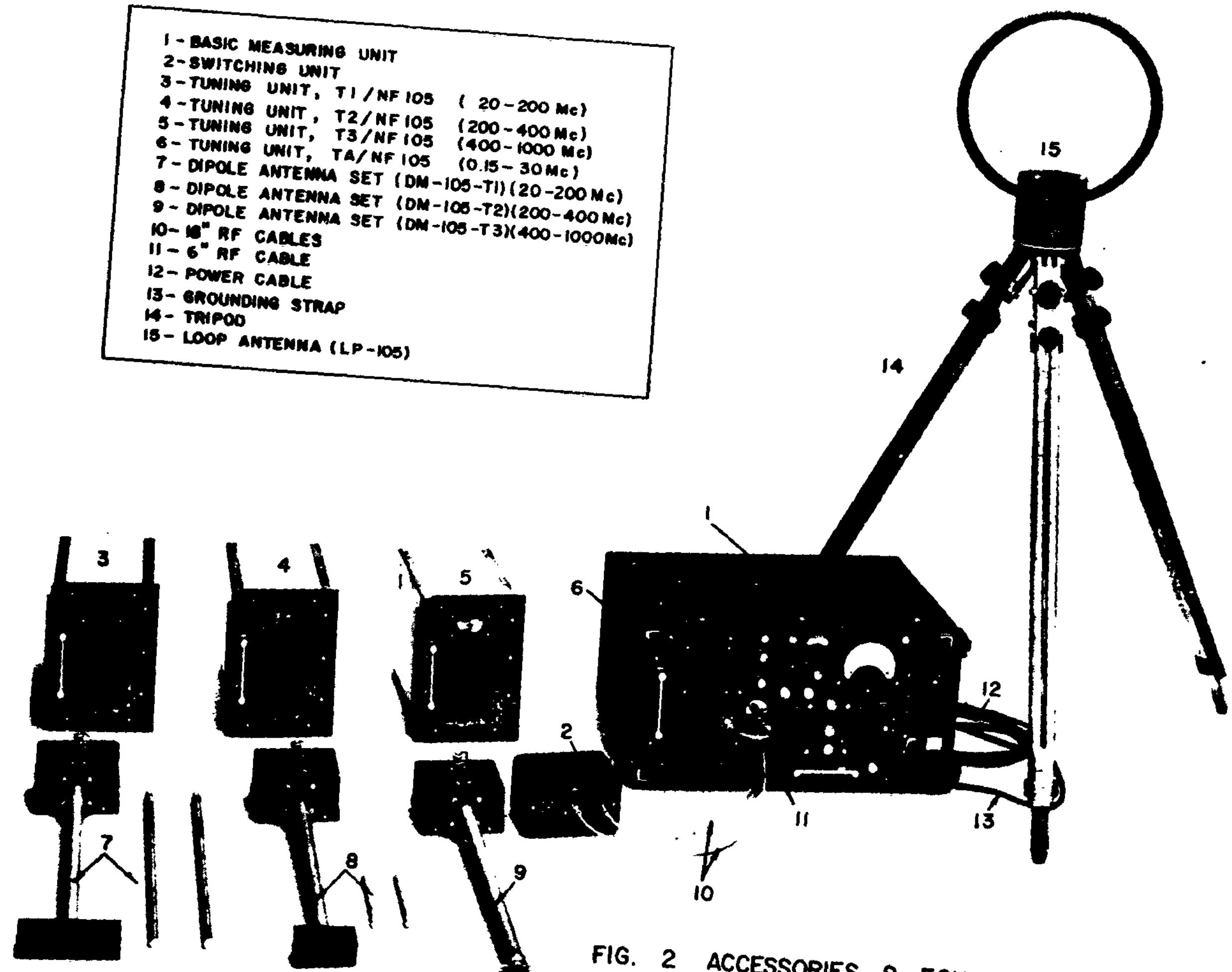


FIG. 2 ACCESSORIES & EQUIPMENT

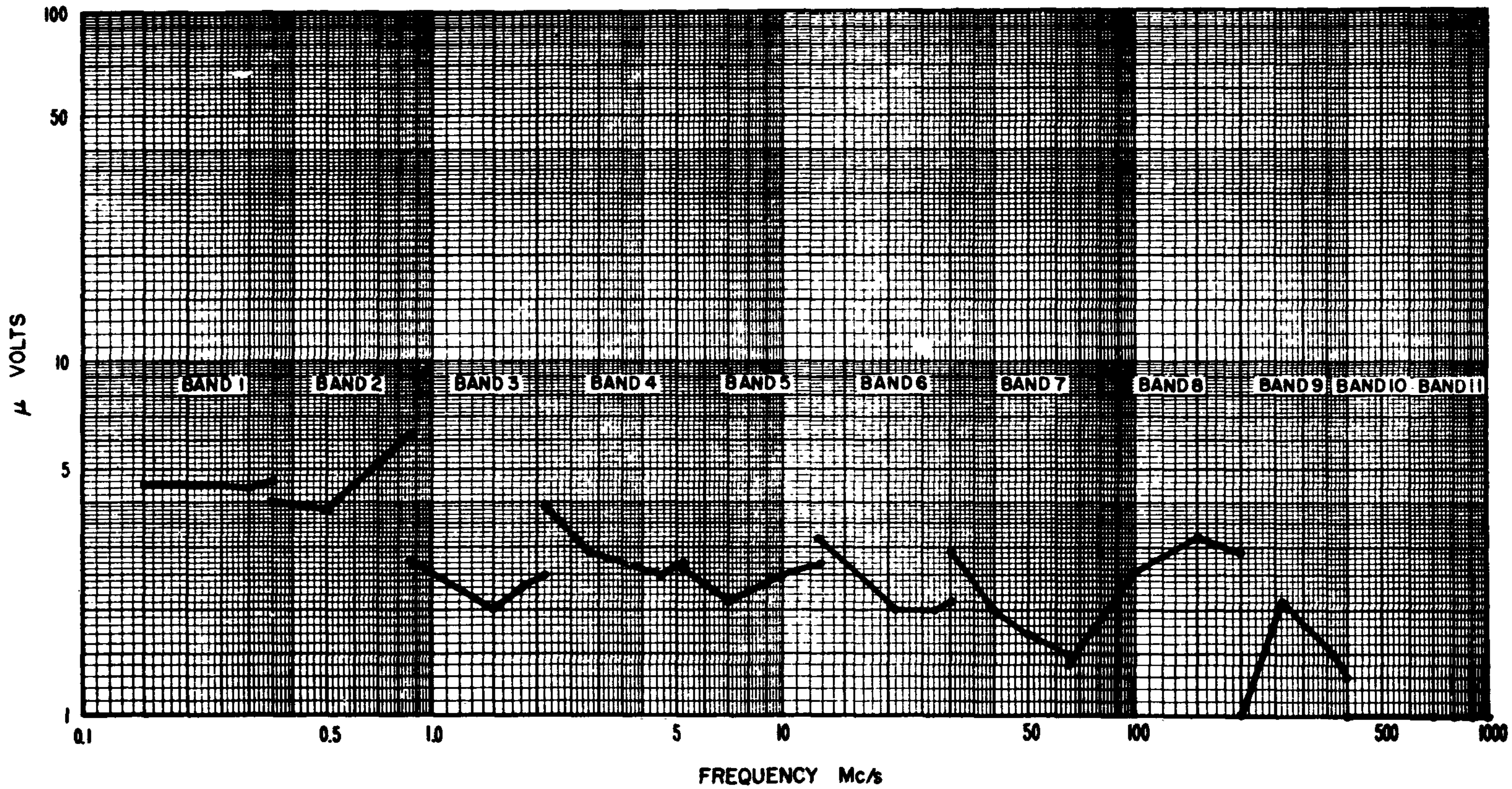


FIG. 3 INTERNAL NOISE

B- 34765

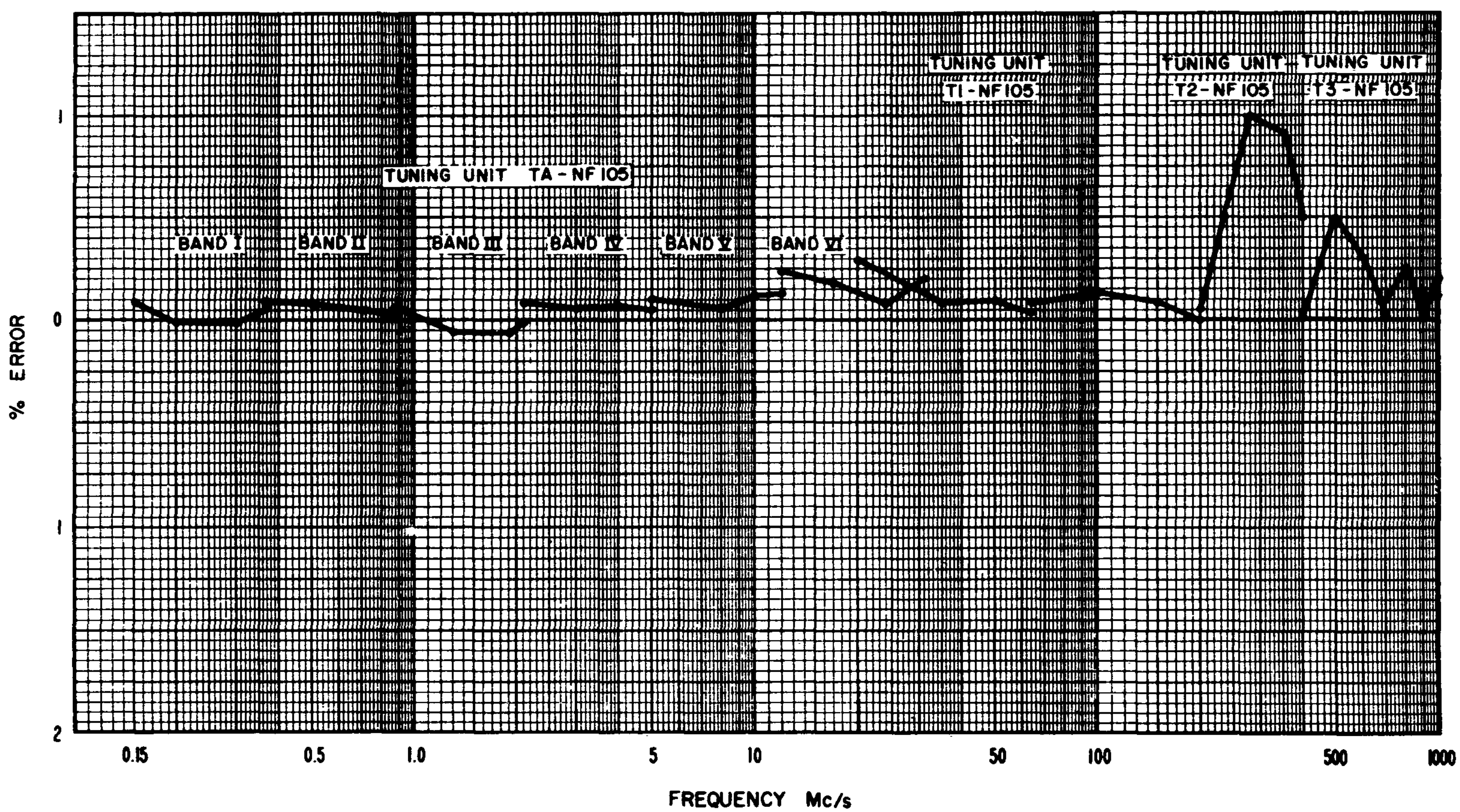


FIG. 4 FREQUENCY SCALE TRACKING

B- 34766

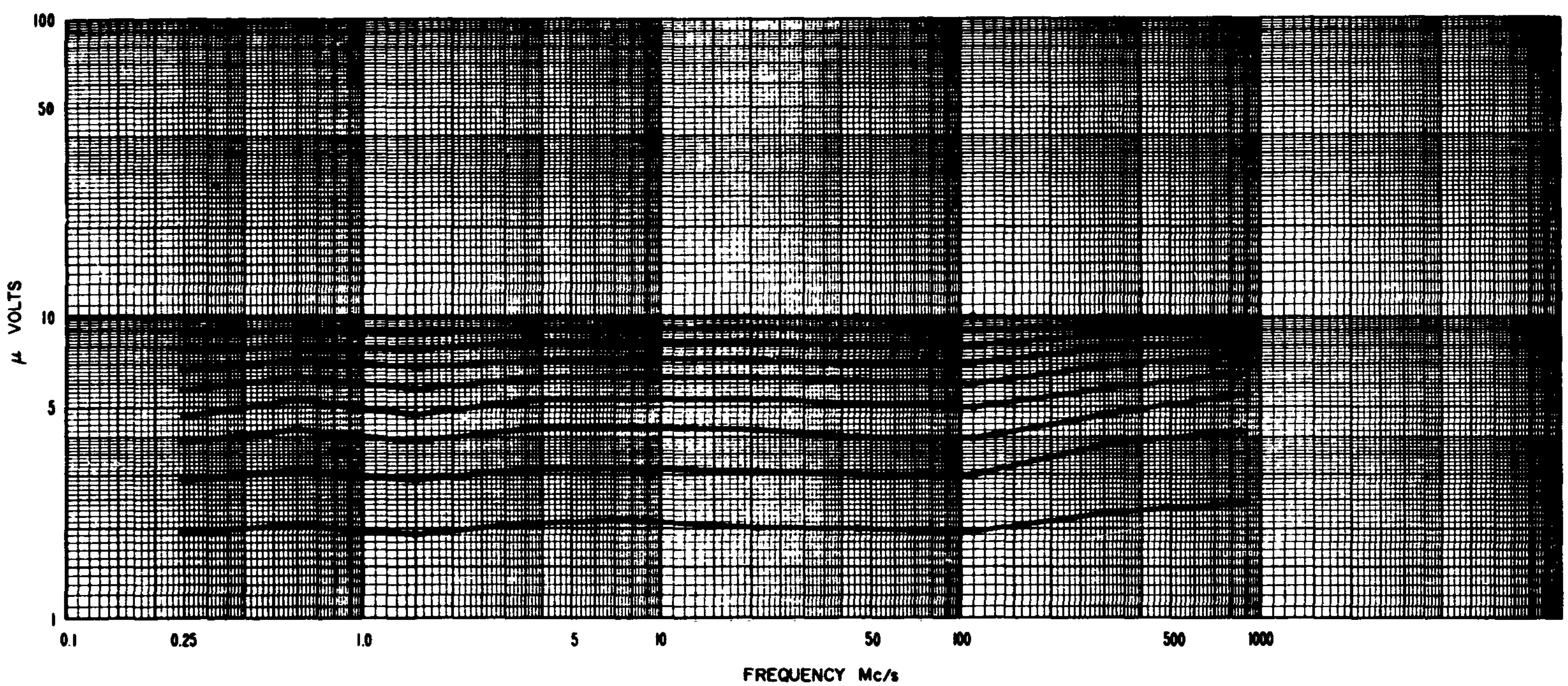


FIG. 5 METER SCALE TRACKING

B- 34767

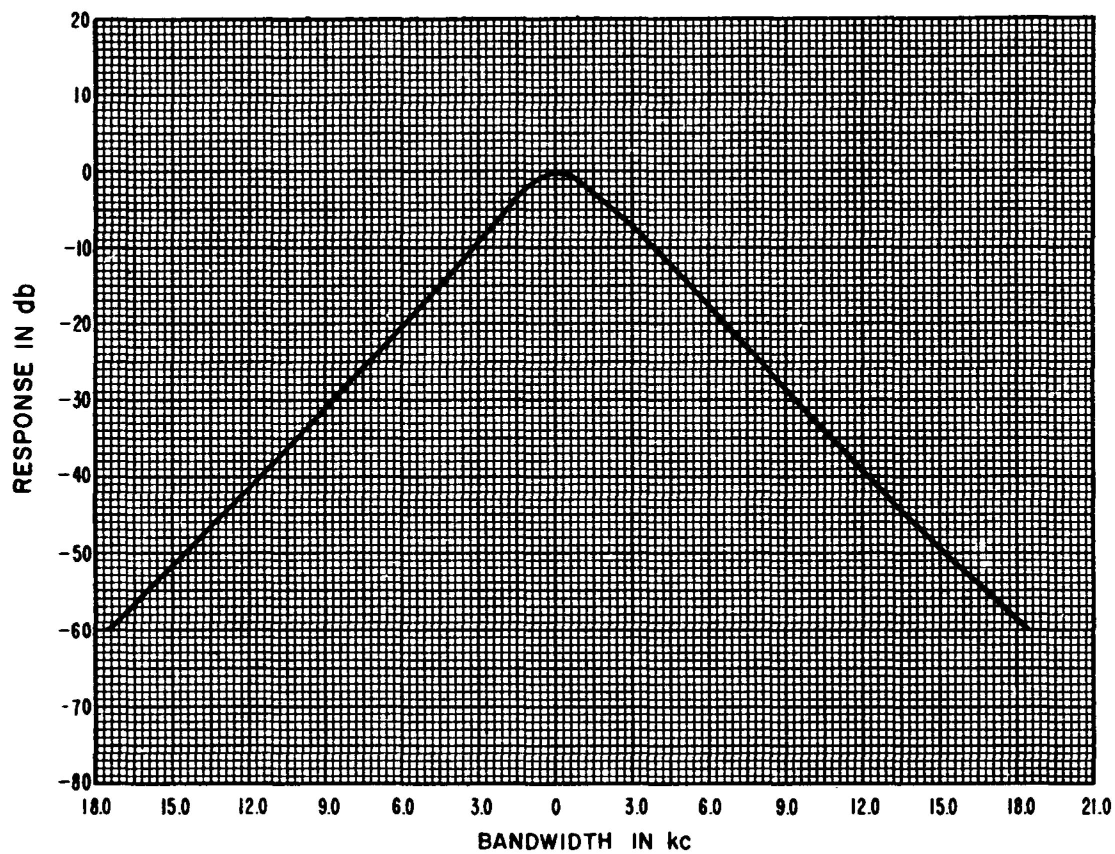


FIG. 6 NF-105, UNIT TA FREQUENCY RESPONSE AT CENTER FREQUENCY OF 0.25 Mc/s

B-32684

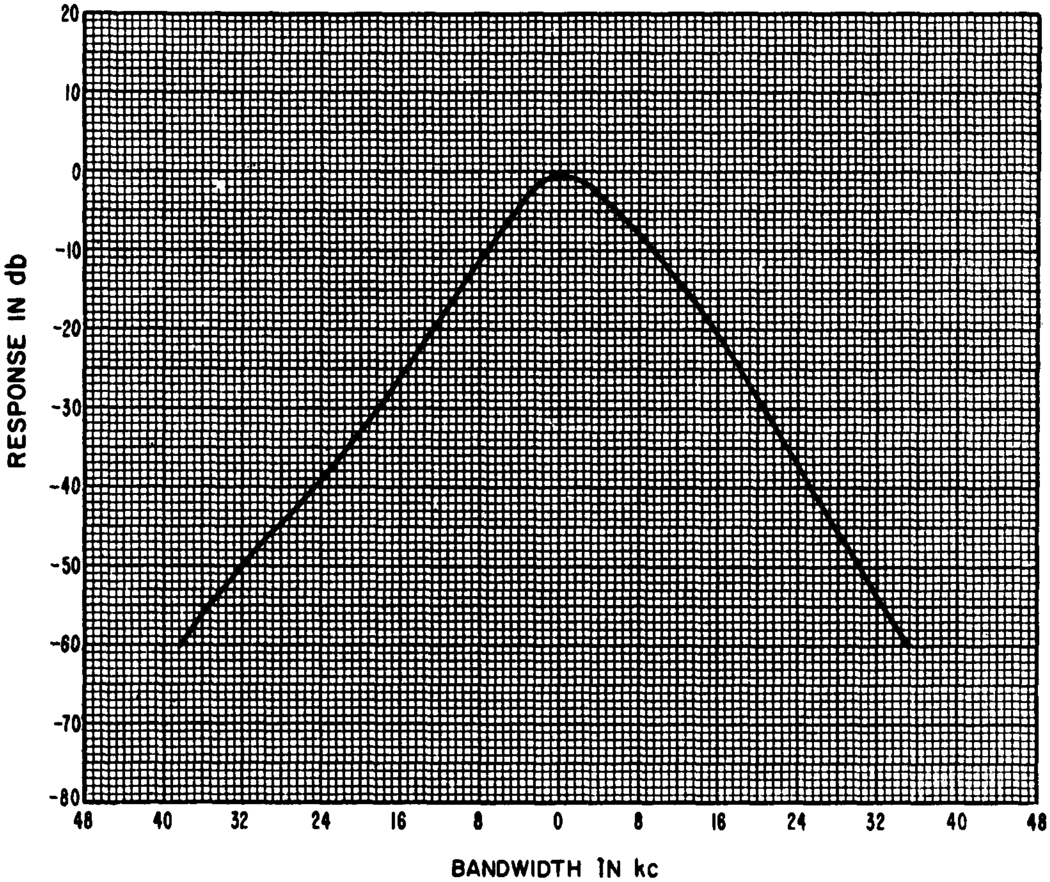


FIG. 7 NF-105, UNIT TA FREQUENCY RESPONSE AT CENTER FREQUENCY OF 0.50 Mc/s

B-32683

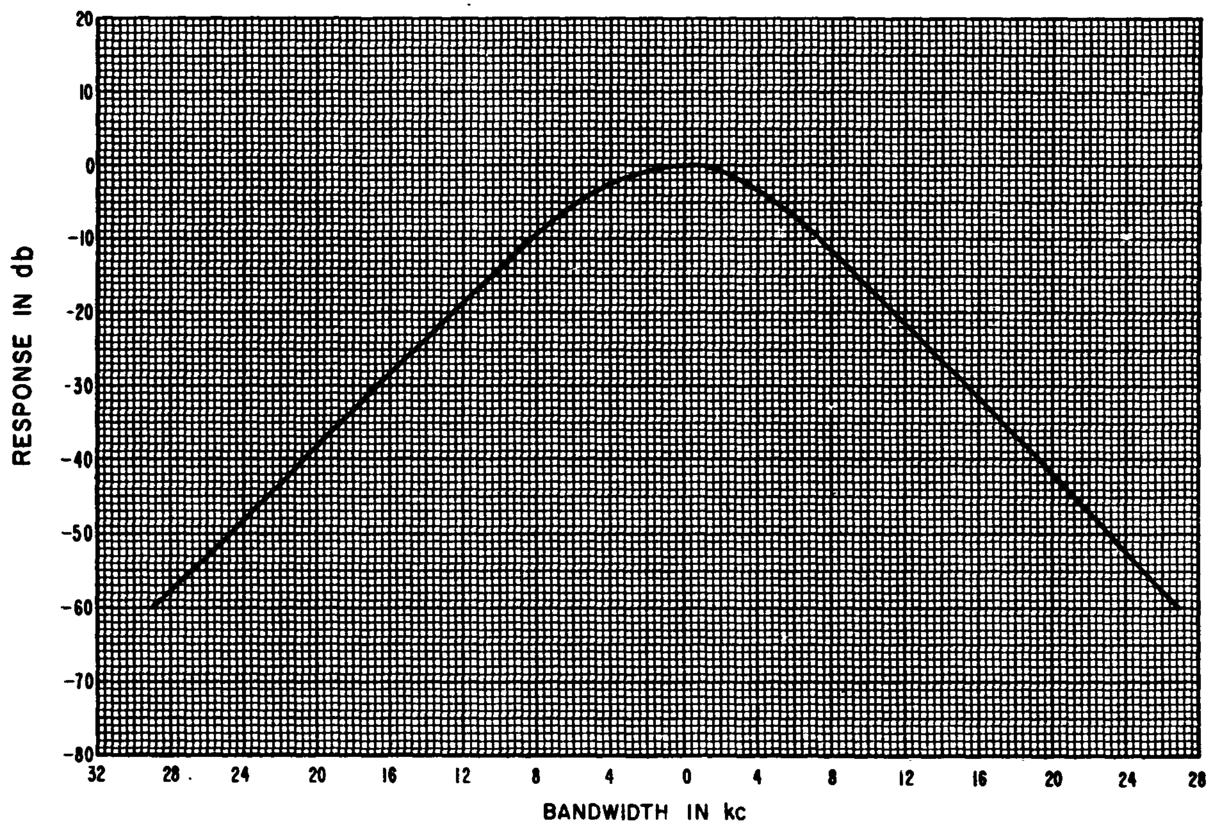


FIG.8 NF-105, UNIT TA FREQUENCY RESPONSE AT CENTER FREQUENCY OF 1.5 Mc/s

B-32685

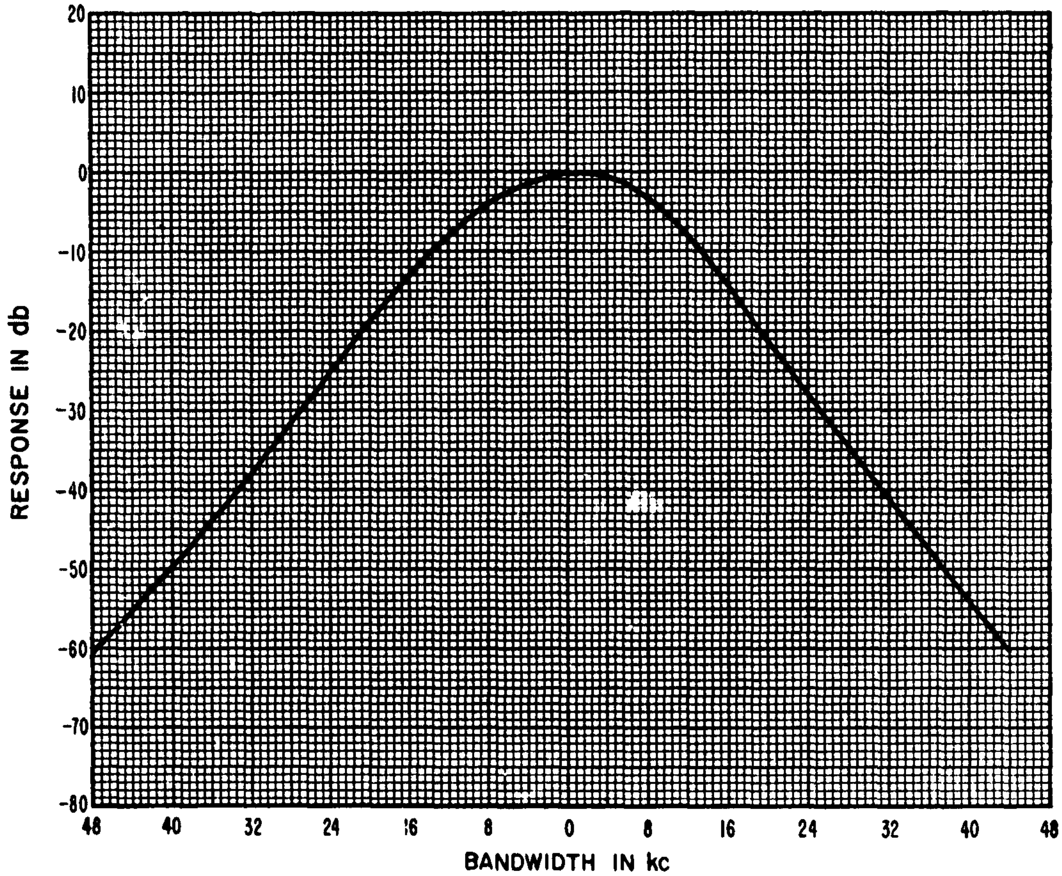


FIG. 9 NF-105, UNIT TA FREQUENCY RESPONSE AT CENTER FREQUENCY OF 3.5 Mc/s

B-32686

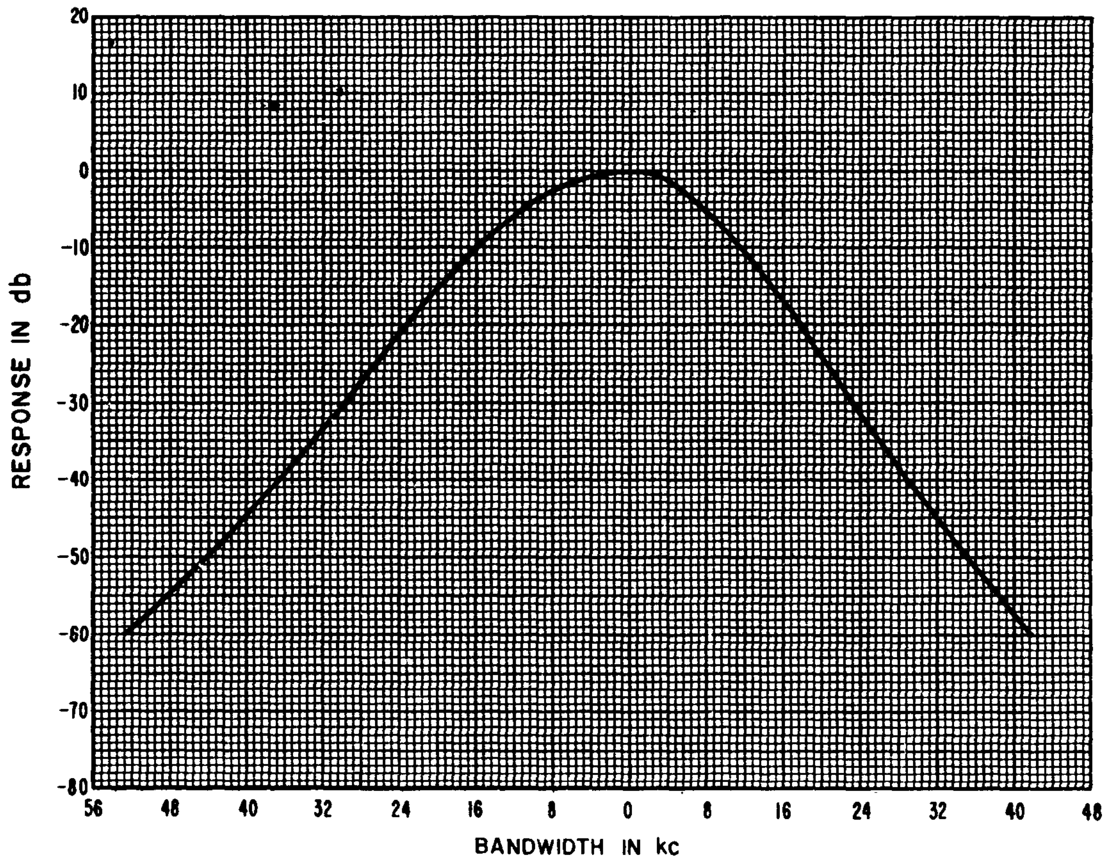


FIG. 10 NF-105, UNIT TA FREQUENCY RESPONSE AT CENTER FREQUENCY OF 9.0 Mc/s

B-32681

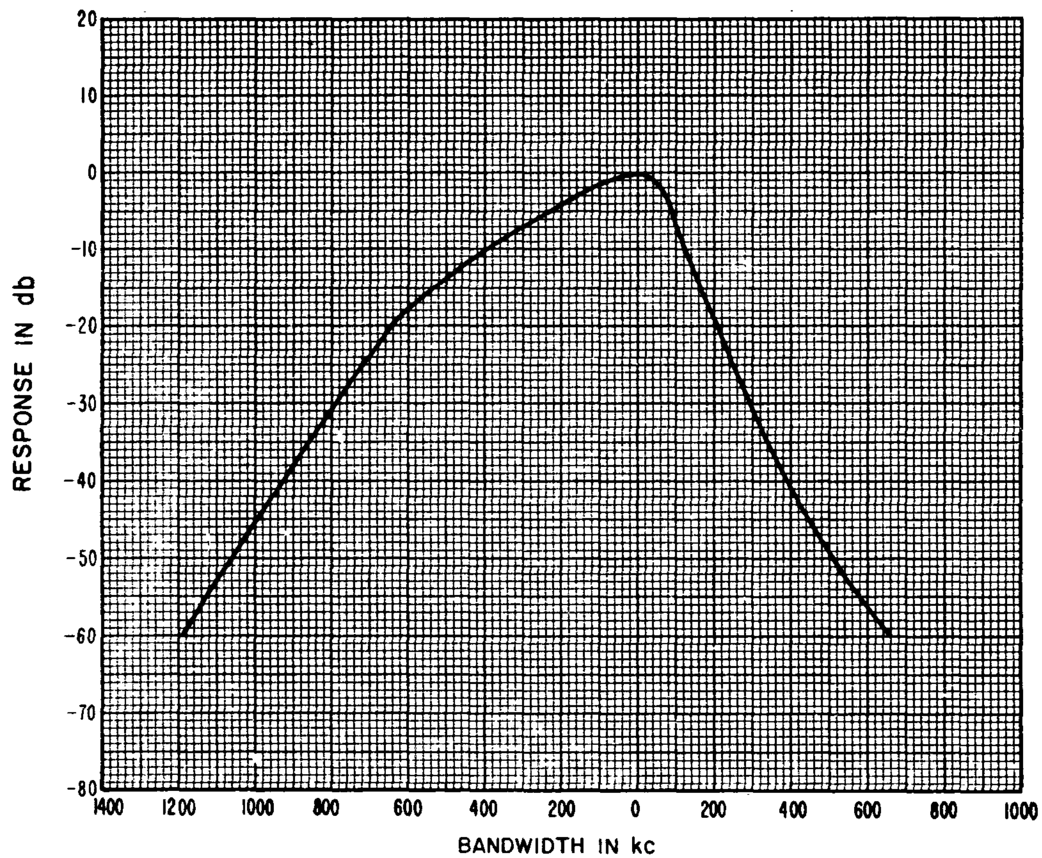


FIG. 11 NF-105, UNIT T2 FREQUENCY RESPONSE AT CENTER FREQUENCY OF 300 Mc/s

B-32682

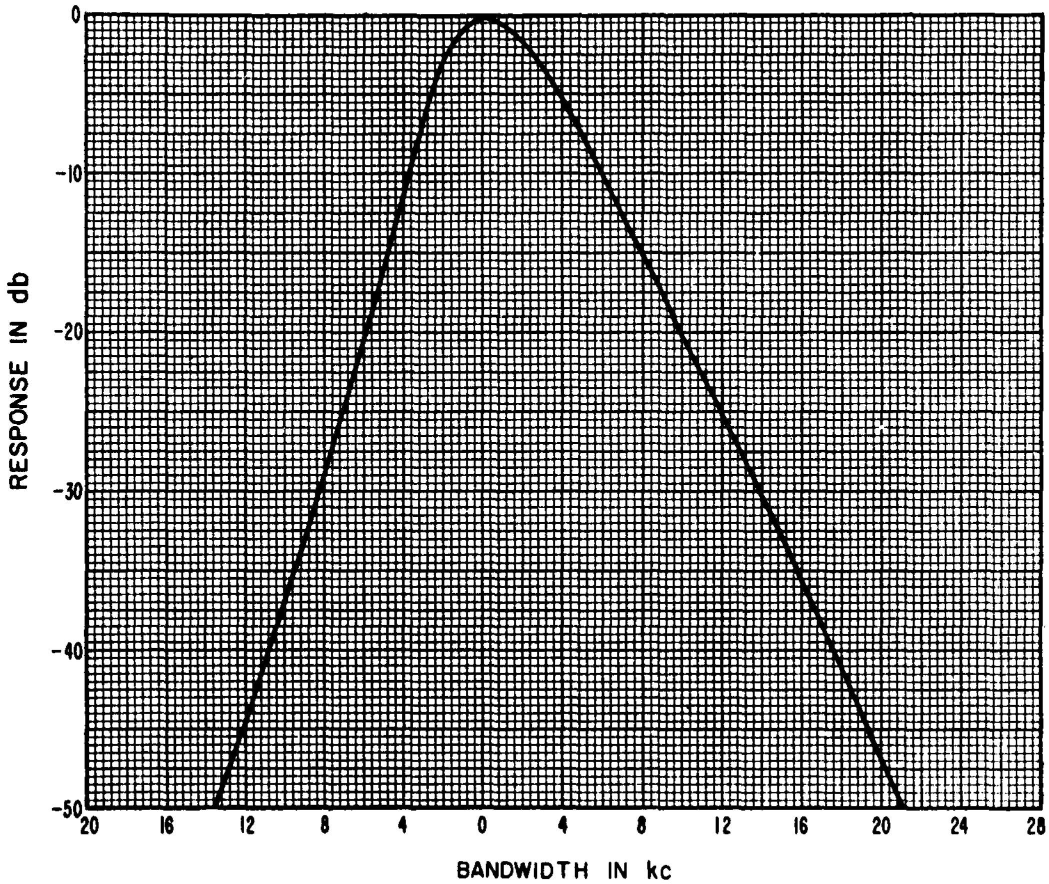


FIG. 12 NF-105 UNIT T3 FREQUENCY RESPONSE AT CENTER FREQUENCY OF 540 Mc/s

B-32687

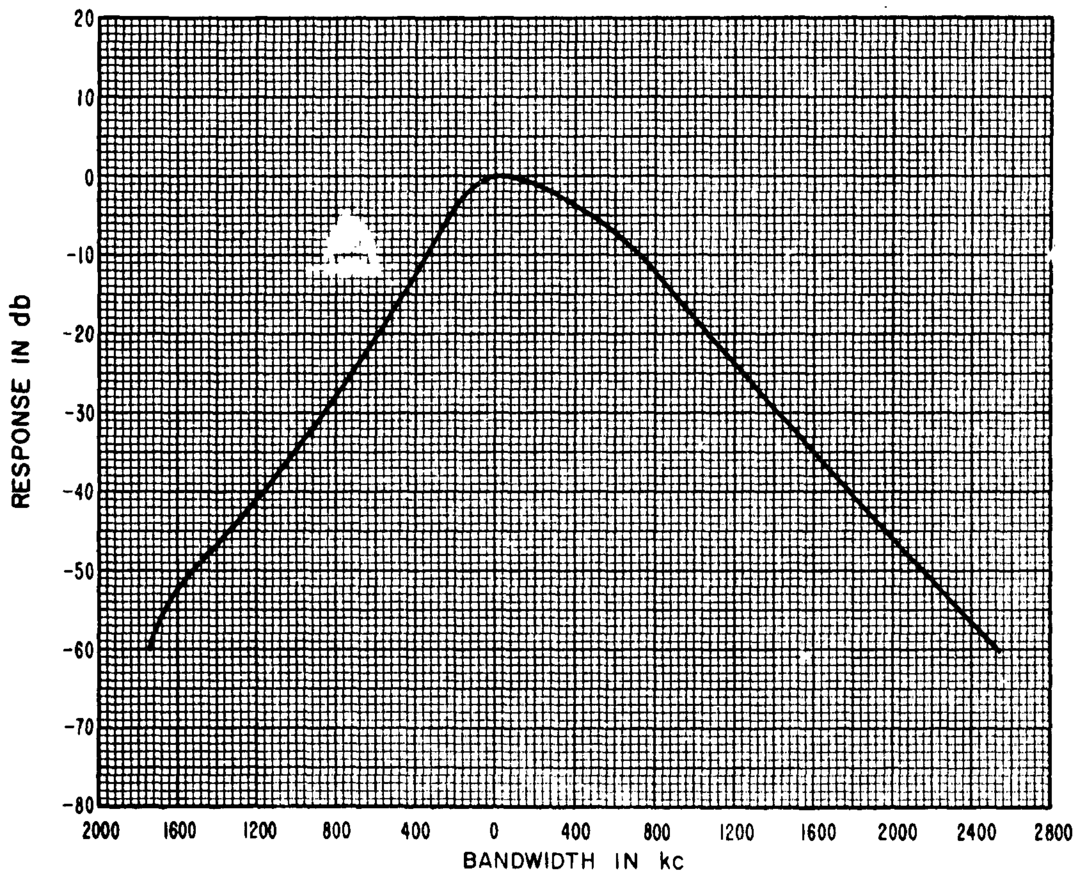


FIG. 13 NF-105 UNIT T3 FREQUENCY RESPONSE AT CENTER FREQUENCY OF 840 Mc/s

B-32688

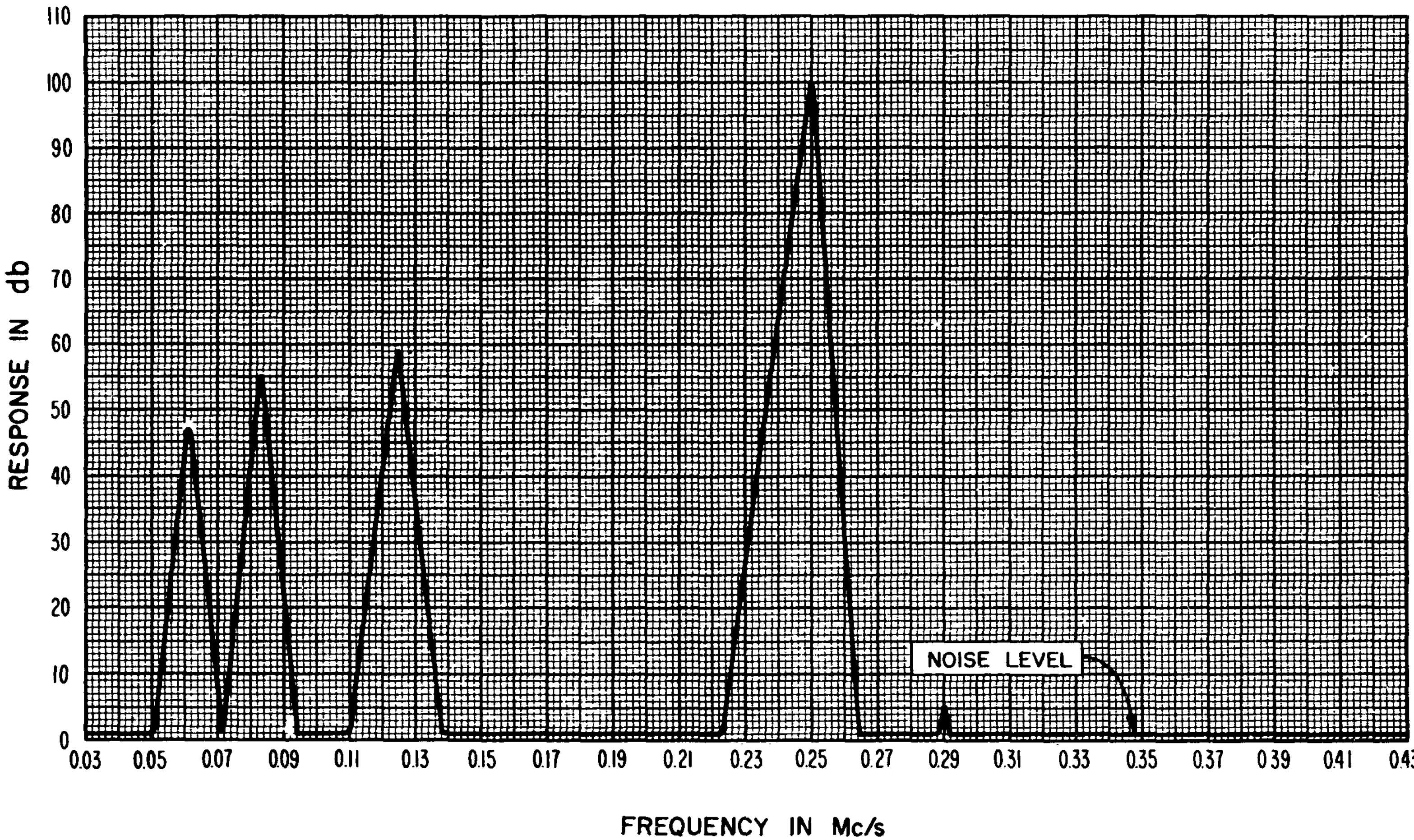


FIG. 14 IMAGE REJECTION OF NF-105

B-37347

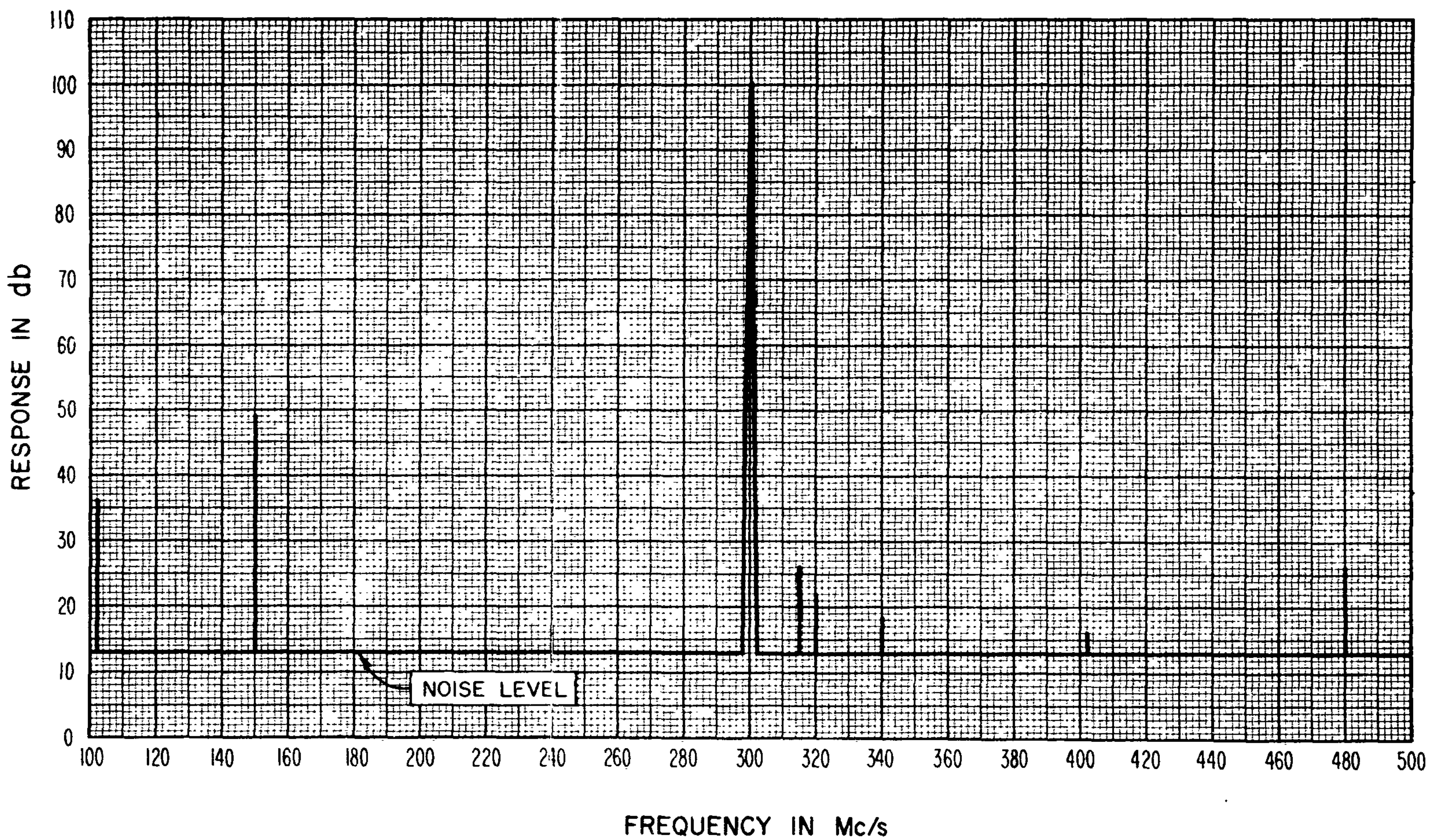


FIG. 15 IMAGE REJECTION OF NF-105

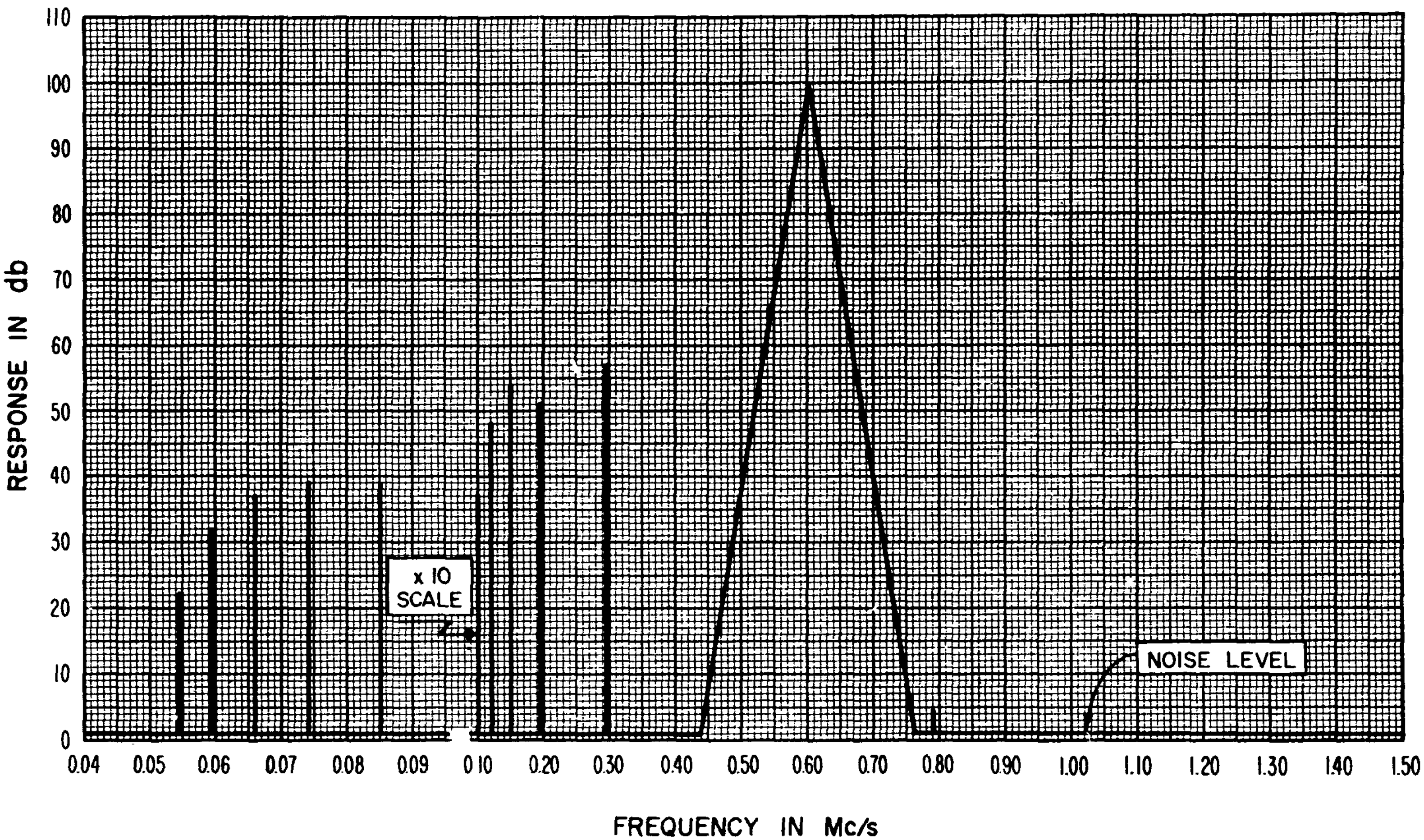


FIG. 16 IMAGE REJECTION OF NF-105

B- 37346

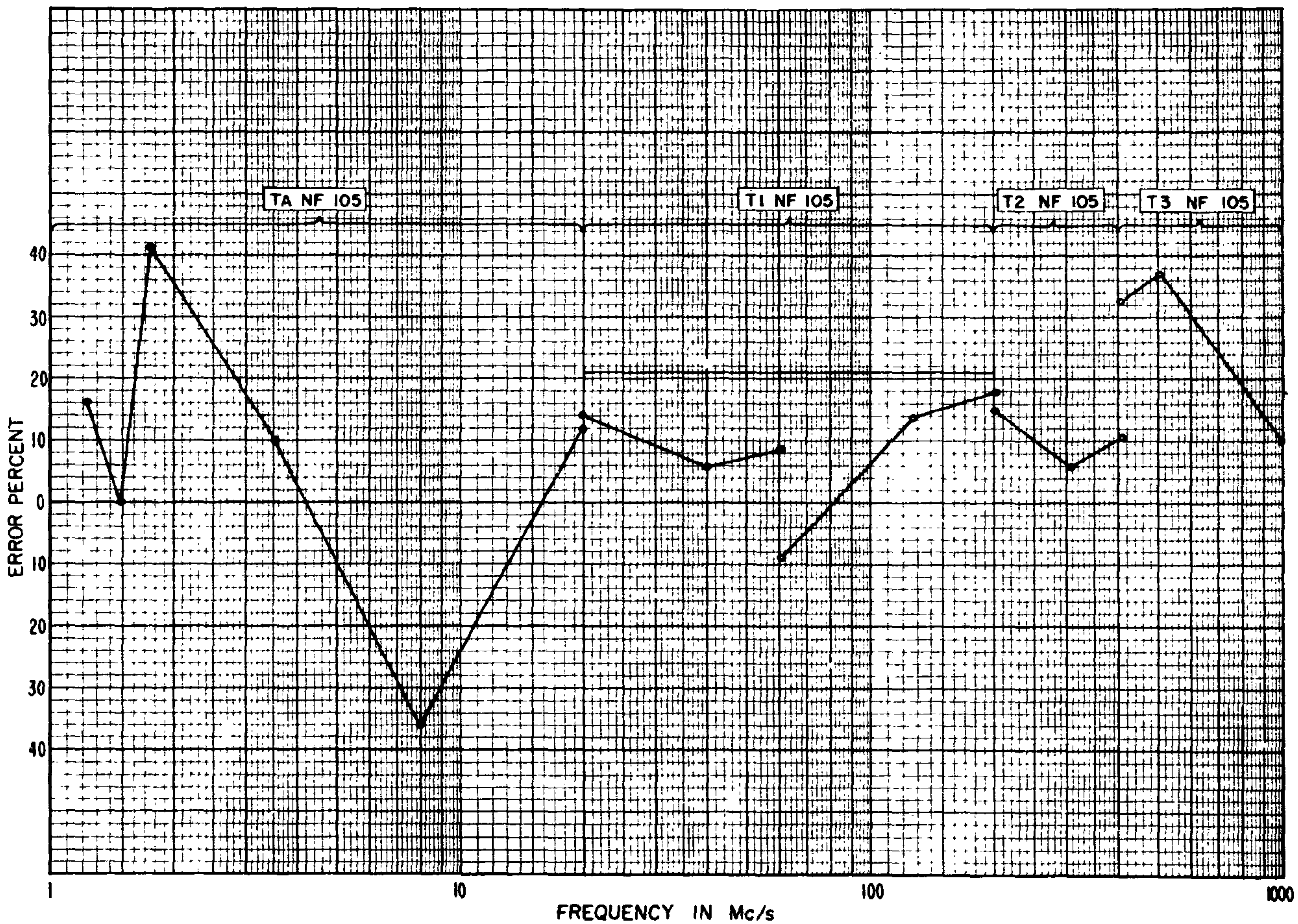


FIG. 17 IMPEDANCE INPUT NF-105

B-32680

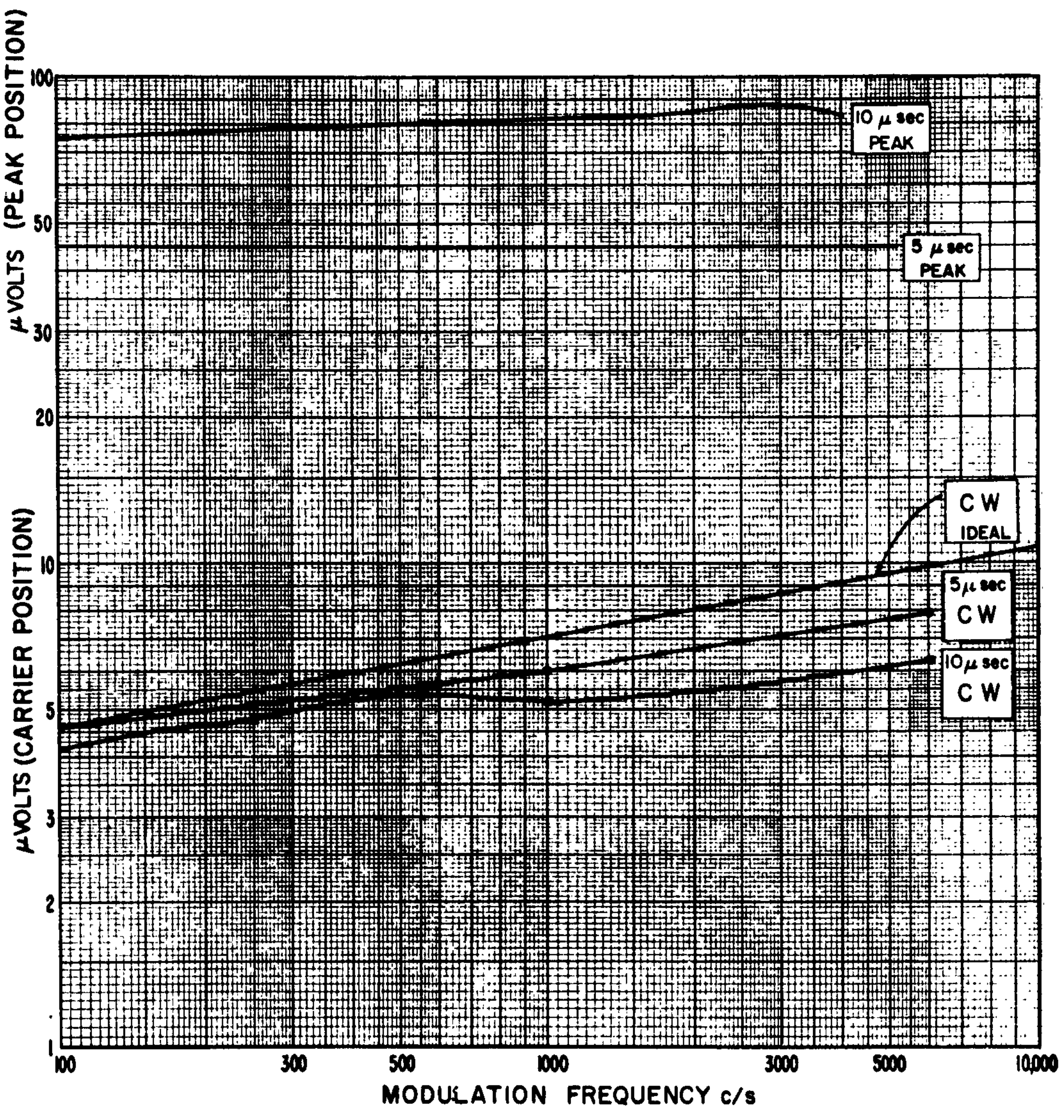


FIG. 18 PULSE LINEARITY NF-105, GAIN NORMAL

B- 32671

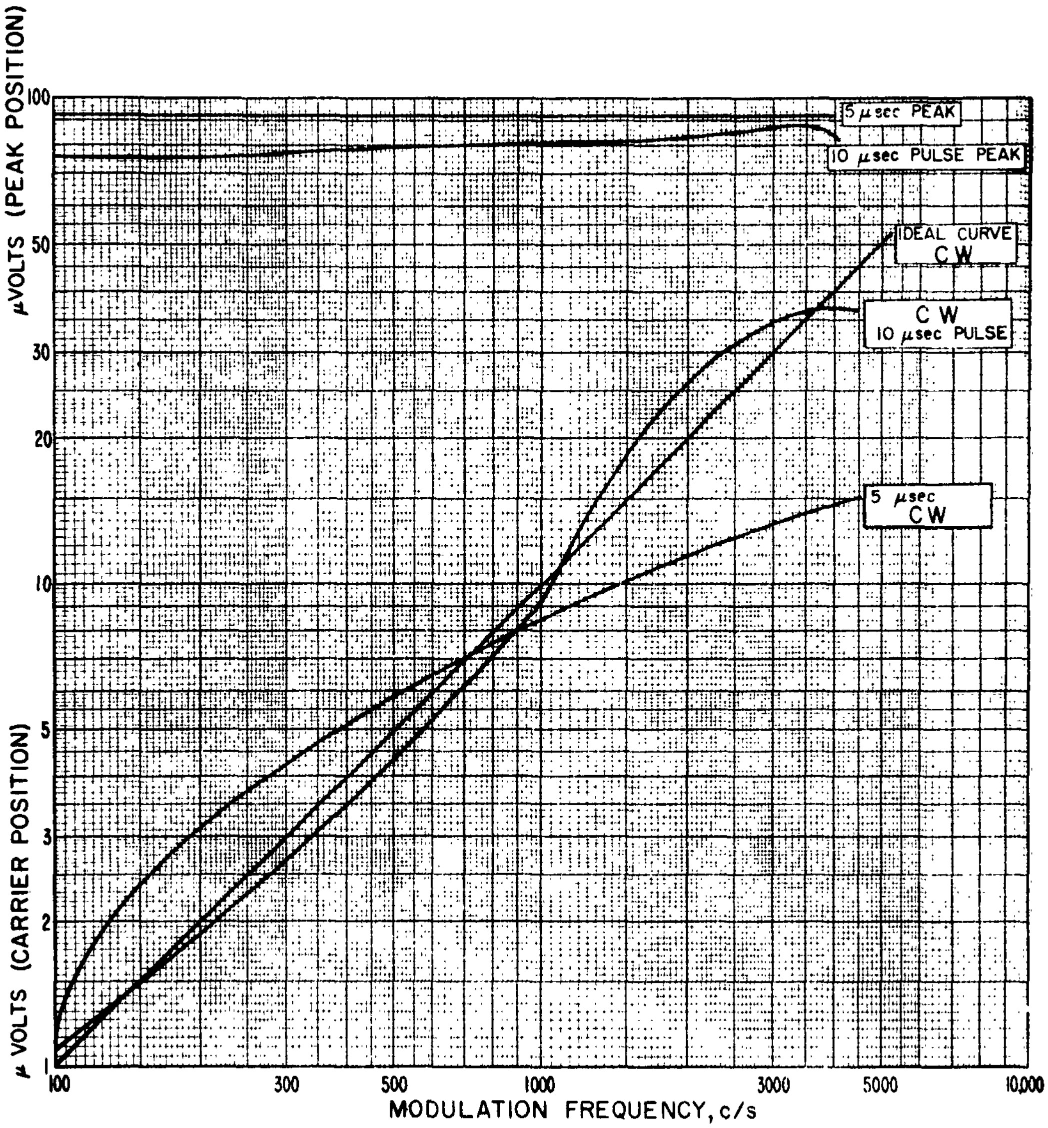


FIG. 19 PULSE LINEARITY NF-105, GAIN 1/5 NORMAL

B- 32672

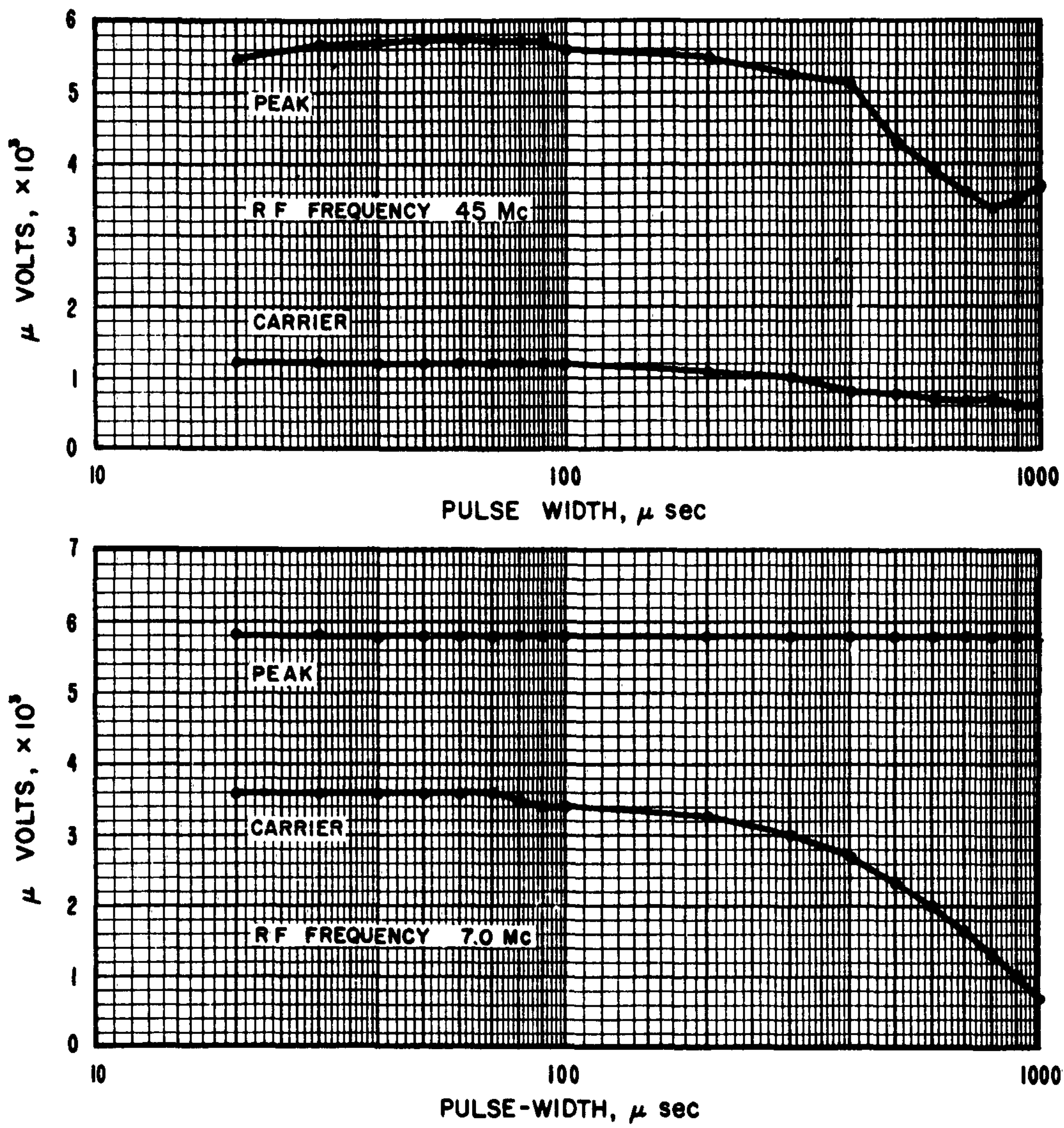
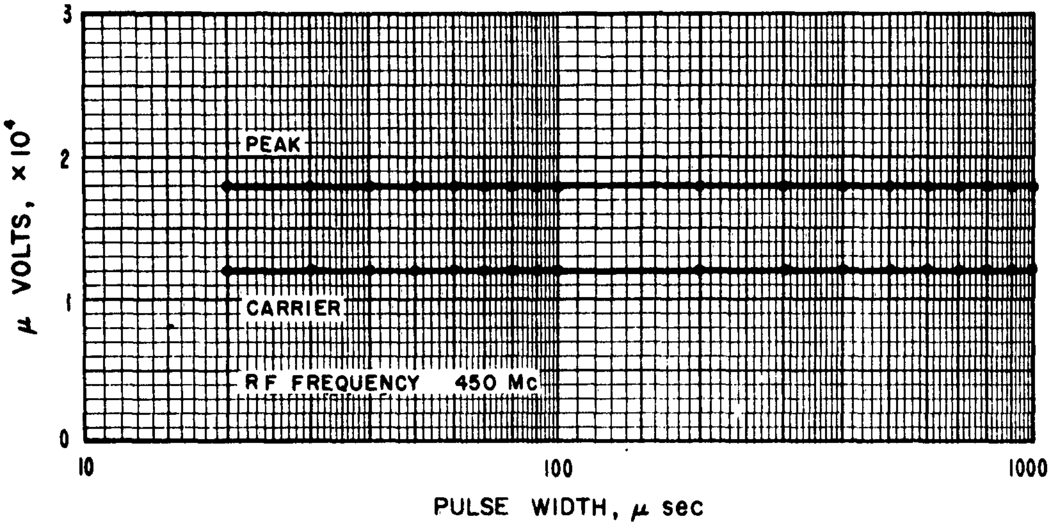


FIG. 20 PULSE RESPONSE

B-34769



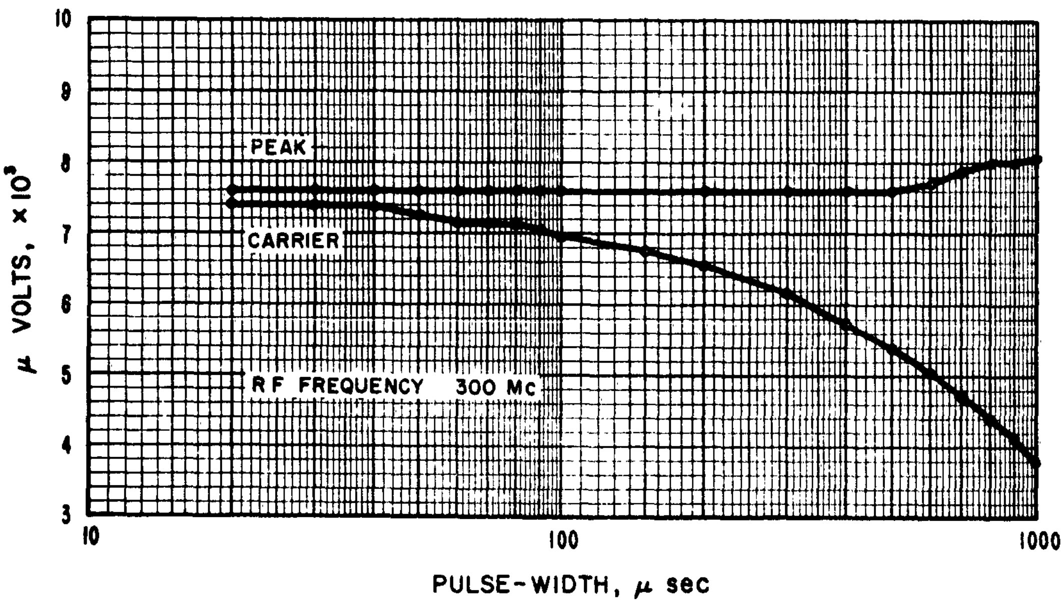


FIG. 21 PULSE RESPONSE

B- 34768

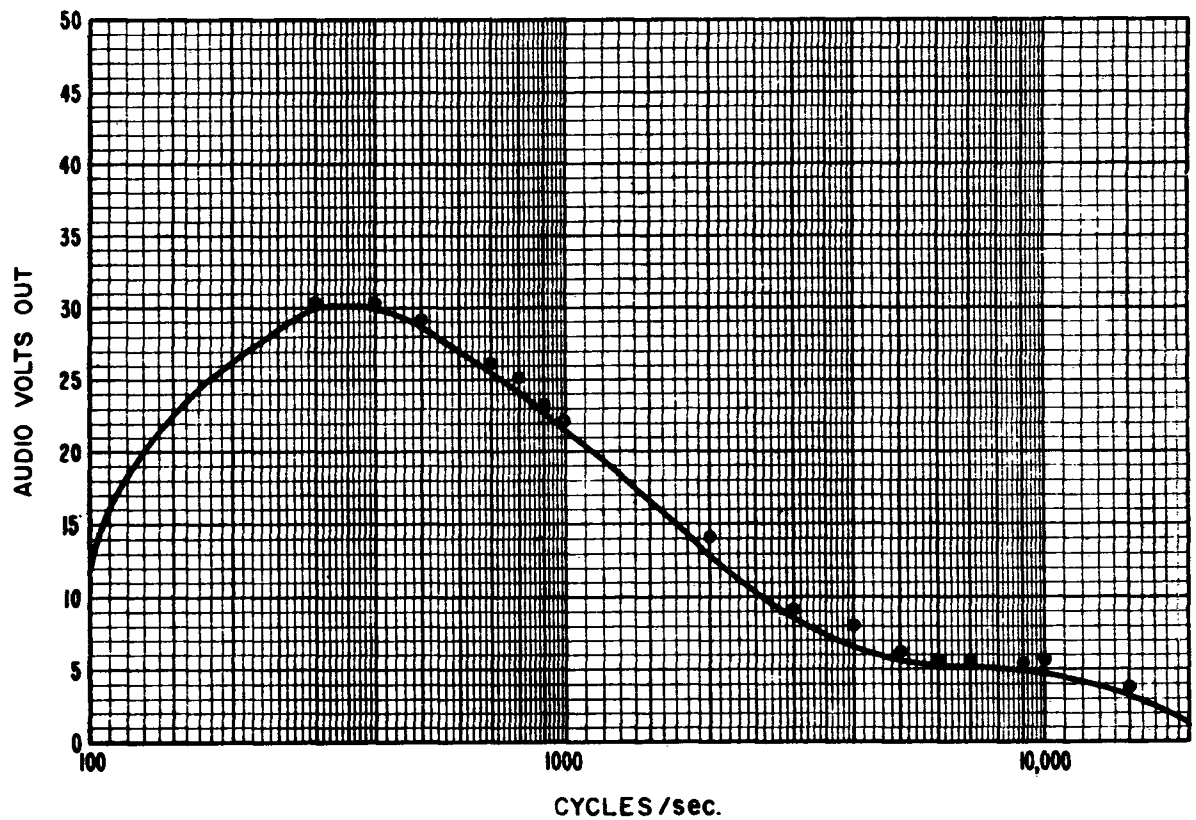


FIG. 22 NF-105 AUDIO RESPONSE, RF FREQUENCY 400 Mc/s

B-32677

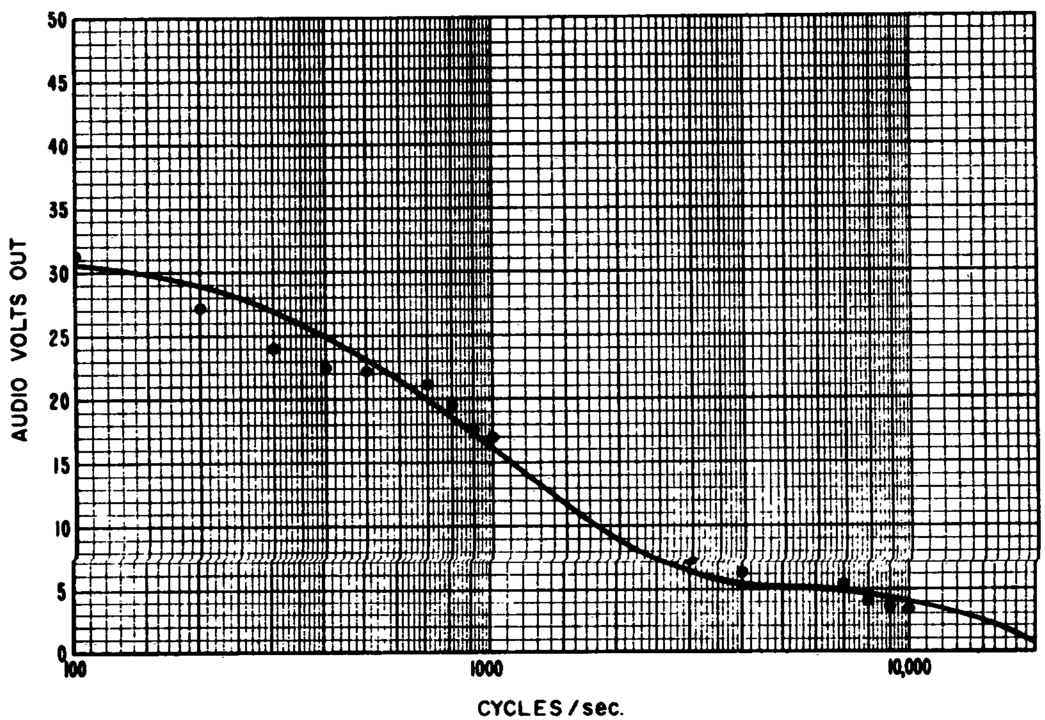


FIG. 23 NF-105 AUDIO RESPONSE, RF FREQUENCY 800 Mc/s

B-32678

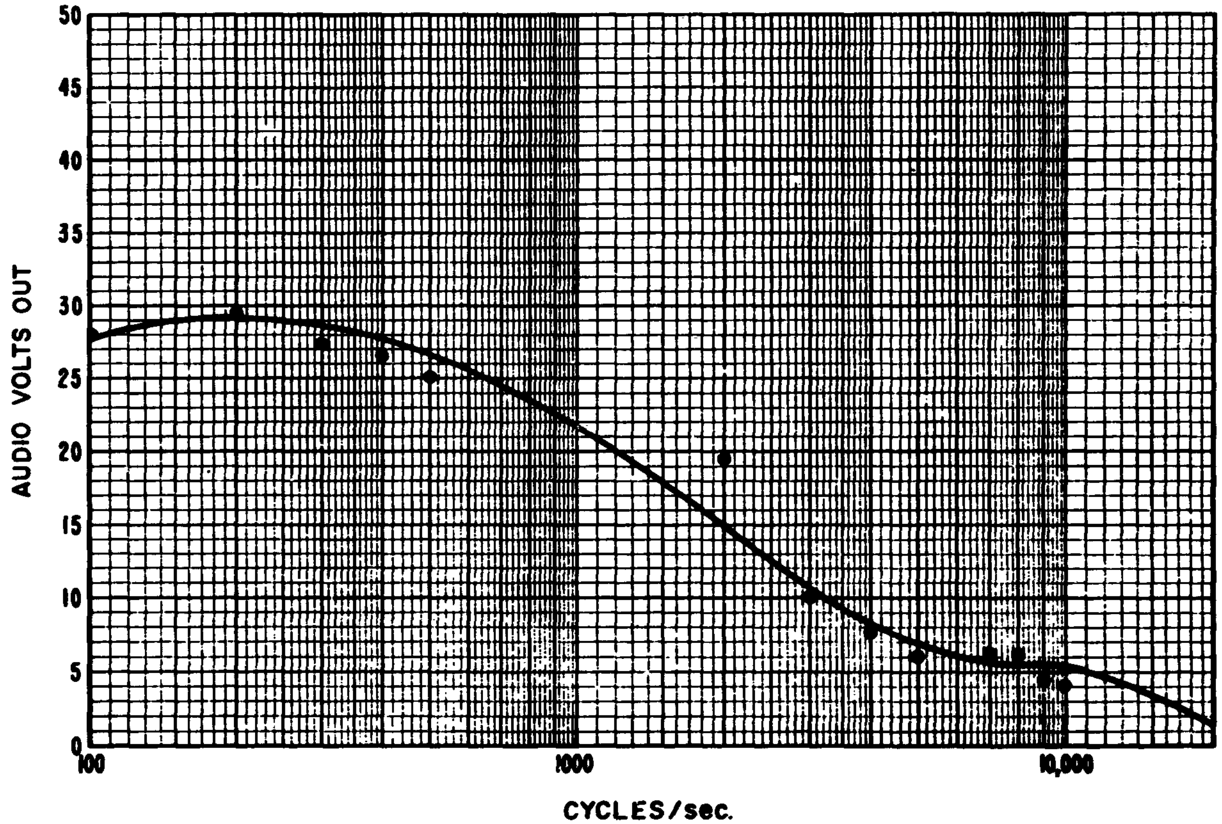


FIG. 24 AUDIO RESPONSE, RF FREQUENCY 1000 Mc/s

B-32679